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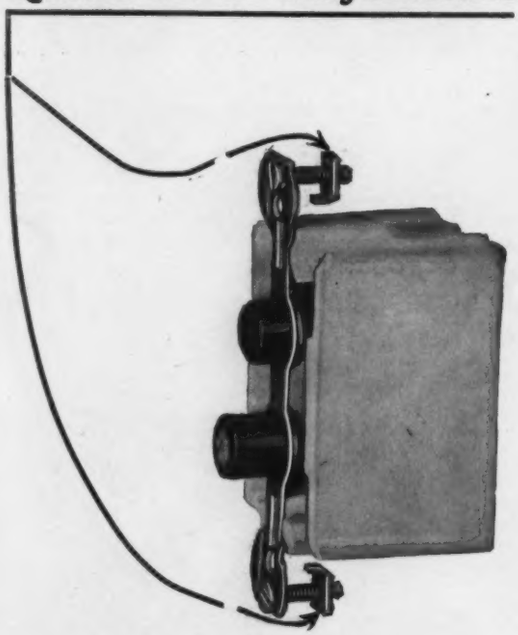

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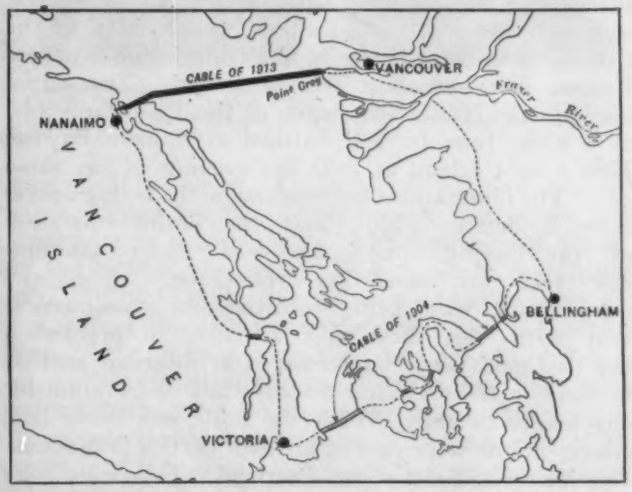
GULF OF GEORGIA SUBMARINE TELEPHONE CABLE

BY E. P. LA BELLE AND L. P. CRIM.

(The paper describes the submarine telephone cable recently laid between Point Grey and Nanaimo, on Vancouver Island, over 30 miles in length. It is continuously loaded, being the first cable of this type in use in America. The construction of the cable is described and illustrated and also the method of laying it. A careful study was made of the relative advantages of a continuously loaded and a coil-loaded cable for the conditions obtaining in this case, and the results have amply justified the selection of the continuously loaded type. The paper was presented at the Pacific Coast convention of the American Institute of Electrical Engineers at Vancouver, B. C., 1913.—The Editor.)

The recent laying of a continuously loaded submarine telephone cable, across the Gulf of Georgia, between Point Grey, near Vancouver, and Nanaimo, on Vancouver Island, in British Columbia, is of interest as it is the only cable of its type in use outside of Europe.

The purpose of this cable was to provide such telephonic facilities to Vancouver Island that the speaking range could be extended from any point on the island to Vancouver, and other principal towns on the mainland in the territory served by the British Columbia Telephone Company.



Route of Cables of 1904 and 1913.

The only means of telephonic communication between Vancouver and Victoria, prior to the laying of this cable, was through a submarine cable between Bellingham and Victoria, laid in 1904. This cable was non-loaded, of the four-core type, with gutta-percha insulation, and to the writer's best knowledge, is the only cable of this type in use in North America. This cable is in five pieces crossing the various channels between Bellingham and Victoria. A total of 14.2 nautical miles (16.37 miles, 26.3 km.) of this cable is in use. The conductors are stranded and weigh 180 lb. per nautical mile (44.3 kg. per km.). By means of a circuit which could be provided through this cable by way of Bellingham, a fairly satisfactory service was maintained between Vancouver and Victoria, the circuit equating to about 26 miles (41.8 km.) of standard cable. All communications to points on Vancouver Island north of Victoria were routed through this cable circuit. As a consequence the speaking range from Vancouver to the Island was limited to a few points near Victoria, and Nanaimo was the extreme limit of commercial service, and conversation was not attempted except under the most favorable conditions. Under some conditions conversation was possible except for the distorting effect of the unloaded cable.

By using the new cable, Nanaimo is made the center of distribution for Vancouver Island. The longest line that will ever be connected at Nanaimo will extend to the north end of Vancouver Island, and will be about 250 miles (400 km.) in length, so it can readily be seen that satisfactory service may be established to any point on Vancouver Island through the new cable. It was with the idea in mind of using Nanaimo as the distributing center that the existing route was chosen for laying the cable.

It is quite important to the long life of a submarine cable that a rock bottom and exposure to tidal currents be avoided as much as possible. It is also quite essential that the shore ends be landed in mud or sand and that they be kept buried, at least as far as the low water line. It is believed that the route chosen will prove to be very satisfactory.

The new cable was manufactured by the Henley Telegraph Works, in England, and has the following mechanical properties:

Conductors. Four conductors, each consisting of a central wire, surrounded by twelve wires of annealed copper, having a total weight of 300 lb. per nautical mile (73.4 kg. per km.); total diameter of conductor 0.1385 in. (3.518 mm.).

Loading. One soft iron wire 0.012 in. (0.305 mm.) in diameter, wound round the conductor and having seventy turns per inch (27.6 turns per cm.).

Dielectric. Three coats of best gutta-percha alternating with three coats of Chatterton's compound.

Total weight of dielectric per nautical mile 300 lb. (73.4 kg. per km.). Diameter over gutta-percha 0.409. in. (1.04 cm.).

Cabling. Four cores laid around a yarn center, wormed, brass taped and served with yarn.

Armoring. Fifteen galvanized steel wires each 9.192 in. (0.487 cm.) in diameter, separately tarred and served with tarred yarn.

Outer Serving. Two coats of tarred yarn, and two coats of preservative compound.

Diameter. Diameter of completed cable 1.956 in. (4.97 cm.).

Weight. Weight of completed cable, eight English tons per nautical mile (4.38 metric tons per km.).

The same type of armoring was used throughout, and on account of the armor wires each being served with tarred jute, the completed cable was very flexible.

The cable has the following electrical qualities, as measured on 31.3 nautical miles (58 km.) of the completed cable in the factory at a temperature of 75 deg. Fahr. (24 deg. Cent.). All quantities per nautical mile.

	Conductor resistance, Ohms.	Electrostatic capacity, Microfarad.	Dielectric resistance.* Megohms.
No. 1 Core	4.004	0.3449	258
No. 2 Core	4.004	0.3455	256
No. 3 Core	4.004	0.3449	268
No. 4 Core	4.005	0.3449	274

* After one minute's electrification.

Per Nautical Mile of Looped Circuit.

	Cores.	Conductor resistance, Ohms.	Electrostatic capacity, Microfarad.
Circuit A	1 and 3	8.008	0.1724
Circuit B	2 and 4	8.009	0.1726
Superimposed or phantom circuit on A and B		4.0045	0.3450

The following values were obtained by an eminent independent testing authority on a length of one-twentieth of a nautical mile cut from the completed cable. Results are per nautical mile, and tests were made with sinusoidal current at a frequency of 800 cycles per second, at a temperature of 56 deg. Fahr. (13 deg. Cent.).

Column A, loop or side circuit cores 1 and 3.
Column B, loop or side circuit cores 2 and 4.
Column C, superimposed or phantom circuit.

	A	B	C	
Effective resistance R	9.16	9.14	4.69	ohms
Effective inductance L	11.56	11.54	5.45	millihenrys
Effective capacity K	0.1647	0.1662	0.3338	microfarad
Effective leakance S	12.24	11.26	19.84	microhms
Ratio S/K	74.3	67.8	59.4	
Attenuation constant	0.01892	0.01874	0.01966	

The following results were obtained in the laboratory of the manufacturers on the completed length of 31 nautical miles (58.5 km.) coiled up in the iron tank and covered with water, using sinusoidal current at 800 cycles per second, as before.

Circuit.	A	B	
Open impedance Zo	349.35	337.4	Vector ohms
	∖32°31′	∖33°54′	angle
Closed impedance Zc	185.75	187.5	Vector ohms
	∕23°53′	∕24°43′	angle
Characteristic impedance Z	254.5	251.4	Vector ohms
	4°19′	∖4°56′	angle
Attenuation constant	0.01946	0.01940	

After laying, the cable was tested for dielectric resistance, for capacity, and for conductor resistance. The transmission equivalent was measured in terms of standard cable and tests were made for crosstalks.

Summary of Tests After Laying.

	Conductor resistance	Mutual capacity
	Ohms	Microfarad
No. 1 Circuit	8.008	0.175
No. 2 Circuit	8.008	0.174

	Electrostatic capacity	Dielectric resistance
	Microfarad	Megohms
No. 1 Core	0.347	445
No. 2 Core	0.349	451
No. 3 Core	0.351	461
No. 4 Core	0.347	461

Constructional Details of the Cable.

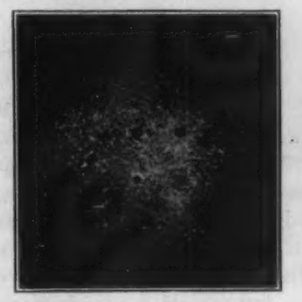
The above results are per nautical mile. Dielectric resistance is corrected to 75 deg. Fahr. (24 deg. Cent.).

The actual length of cable in use is 28.3 nautical miles (52.5 km.) and its mean temperature was 49.6 deg. Fahr. (9.8 deg. Cent.) at the time the measurements were taken. Speech tests showed a standard cable equivalent of eight miles with zero loop on each end, and 5.75 miles, with 12 miles of standard cable at each end to reduce reflection losses.

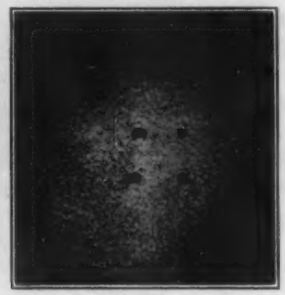
The finished cable was shipped from England to Vancouver on the ship Crown of Galicia. It was stored in a steel tank while on shipboard and kept under water. The temperature was observed daily throughout the voyage. Upon arrival at Vancouver, it was transferred from the tank in the hold of the Crown of Galicia to the hold of the barge Princess Louise, from which it was later laid. The actual operation of laying was begun at the Point Grey end at 4 a. m. June 16, and finished at Kanaka Bay on New Castle Island at 7:30 the evening of the same day. The illustrations herewith show the laying operations in detail. Throughout the entire operation of the laying, one pair was under continuous test for insulation resistance, while the other pair was being utilized for communication with the shore. As a matter of precaution the two pairs were interchanged at intervals so that no fault in the dielectric could escape observation for any length of time. While the cable was being laid, conversations were carried on with parties in Vancouver, Victoria, Seattle and Portland. Two tugs were used to tow the cable ship, which was without power of its own. Telephonic communication was maintained with the tugs by means of rubber-covered wires strung on the hawser. Observations to determine the location were taken at regular intervals with a sector, and a log of operations was carefully kept. The tension on the cable was observed by means of a dynamometer, and the amount of cable paid out was read from the rolometer attached to the paying-out drums. With the exception of a light rain in the morning, the weather was excellent, and a number of guests observed the laying operations, which were without accident.

A cable hut is provided at each of the shore ends for housing the protective apparatus and making the connections between the cable and the aerial land lines. The protective apparatus is of the Lodge-Muirhead type, and consists of three reactive coils with four discharge points, located around a central brass disk, which is grounded to the armor wires of the cable. Each of the cable cores is laid through a protector of this type, and a fuse is inserted between the protector and the line wire, and also between the protector and the cable. All of the protective apparatus is housed in a waterproof cast iron case.

The two physical circuits provided in this cable were satisfactory in every way, and are each equivalent to about 5.75 miles of standard cable. The phantom circuit, however, is not so satisfactory. It is only fair to the manufacturers, however, to state that a satisfactory circuit was not guaranteed. It will be seen that the capacity and leakance of the phantom circuit is just two times as great as in the physical circuits, while the resistance and inductance are about one-half each. This causes the attenuation constant of the phantom to be somewhat greater than that of the physical circuits. There is also some crosstalk between the physical circuits and the phantom, being



Distribution of Magnetic Flux in Four-Core Cable, Current Flowing in Physical Circuit Only.



Distribution of Magnetic Flux in Four-Core Cable, Current Flowing in Phantom Circuit.

equivalent to about 75 miles (120 km.) of standard cable. Tests for this determination were made with local battery sets in the cable huts connected directly to the ends of the cable. This crosstalk is undoubtedly caused by inductive unbalance in the cable. On account of the salt water penetrating to the outside core of the gutta-percha, the wires are shielded from each other electrically. Any disturbance that is transmitted from one wire to another must, therefore, be of an electromagnetic nature. The capacity of the cores in this type of cable depends upon the thickness of the dielectric, and in every case is the capacity from the wire to the ground (salt water), as the sea water penetrates the cable to the gutta-percha. Efforts to decrease the capacity of this type of cable by a paper wrapping under the gutta-percha, in order to increase economically the diameter, have failed because of the moisture content of the gutta-percha being absorbed by the paper.

The uniformity of the capacity then depends upon the cores being exactly of the same dimensions and located symmetrically. It can readily be seen that a slight eccentricity of conductor in the dielectric will change the capacity accordingly.

The inductance of these cable circuits is artificially increased by a winding of soft iron wire around the copper conductor, which increases the permeability of its magnetic field. This is the well-known Krarup system of continuous loading. The permeability of this wire may be affected in three ways, namely, ageing, by straining it beyond its elastic limit, and by permanently magnetizing it. Ageing occurs in nearly all iron used in magnetic circuits, and the magnitude of the change of permeability varies with the different pieces of iron. It is thus possible that the inductance of the different cores of the Krarup cable might be thrown out of balance by the iron wires ageing differently. It is known that the permeability of magnetic iron is affected by straining it beyond its elastic limit. When it is considered that the leading wire is only 0.012 in. (0.305 mm.) in diameter, and that in order to hold it around the copper conductor so that it will remain evenly distributed, it is necessary to apply it with considerable tension, it is more than likely that a considerable amount of this wire has been heavily strained. This is indicated by its appearance. During manufacture the different sections of core were spliced together in such a way as to neutralize as far as possible any unbalances that could be detected at that time. It will be seen that the total capacities and inductances of the different cores are in a fair degree of balance. There is very little danger of the iron wrapping used in continuous loading ever becoming permanently magnetized, as this would require a very heavy current.

It is customary to measure the direct-current insulation resistance of a gutta-percha core at 75 deg. Fahr. (24 deg. Cent.), and after one minute's electrification. The insulation resistance increases quite rapidly after the initial electrification, and only reaches a fairly constant state after some time. This effect, although not well understood, seems to be somewhat similar to the polarization effect of an electrolytic couple. The dielectric resistance so obtained cannot be used to deduce the leakance S for calculating the attenuation constant and circuit impedance. Measurements for this quantity must be made at telephonic frequencies and voltage, and owing to the extremely small quantity of power involved, are exceedingly difficult to make with any degree of precision.

Gutta-percha is rarely employed as an insulator for telephone conductors, with the exception of submarine cables in deep water. While information regarding its various characteristics is not very plentiful, a brief statement of its qualities may be of interest.

It is composed of pure gutta, rosin and water. It is a vegetable gum secured from certain tropical trees very much the same as India rubber. It is collected by native labor, and shipped in the raw state to the factory, where it is prepared for commercial use. The first step in its preparation is to remove all impurities, as far as possible, which is done by boiling in water. It is then put through a masticating machine, after which it is rolled out into thin sheets.

The wire which is to be insulated with gutta-percha is first given a coat of Chatterton's compound, and then a coat of gutta-percha is applied with a sheathing machine, in much the same manner as lead sheaths are applied to the ordinary paper-insulated telephone cable. Additional layers are applied alter-

nating with layers of Chatterton's compound, until the required thickness of dielectric has been obtained. It should be noted that gutta-percha is not subjected to any process similar to the vulcanization of rubber, but is used in the raw state. It contains no sulphur, and copper wires do not require tinning before being insulated with gutta-percha.

In general, rosin does not increase the initial insulation resistance of gutta-percha, but if it is present in too great proportions it tends to separate, especially upon exposure to heat and light, and causes cracks to form in the insulation. Ordinary grades contain from five to six per cent moisture. The insulation resistance increases very rapidly with a decrease in temperature, so that at 45 deg. Fahr. (7.2 deg. Cent.) its insulation resistance is about ten times that at 75 deg. Fahr. (24 deg. Cent.). If it is heated much above 80 deg. Fahr. (27 deg. Cent.) it soon softens, and in a completed cable this would allow the cores to become deformed, especially if the cable were subjected to any considerable pressure, such as the lower coils in a cable tank. Instances have been known where the copper conductor by its own weight became so eccentric in the core that a large quantity of the cable was ruined on account of the insulation becoming too thin.

Generally speaking, if different grades of gutta-percha are mixed together, a higher dielectric resistance is obtained, but the fibrous structure is not so good as if one quality were used throughout.

The splicing of a gutta-percha-insulated conductor is one requiring no little skill and care. It is necessary in splicing a four-core cable that the spliced conductors be of equal length, so that no one splice will be subjected to more than normal stress. In splicing the conductors the ends are scarfed and soldered together. Then the joint is given a close wrapping of fine copper wire, which is also soldered all over. A second wrapping of fine copper wire is then applied in reverse direction and soldered only at the ends. In case the joint was so strained as to break the soldering in the main conductor of the first wrapping copper wire, this last spiral wrapping would still form a metallic connection across the break. In joining the dielectric, the same number of layers of gutta-percha are applied, alternating with Chatterton's compound, as are used in the manufacture of the core. The gutta-percha is warmed with a spirit lamp until plastic, and is applied with the fingers. The finished splice must not have a much greater diameter than the unspliced core and must show leakance not in excess of a piece of core ten times the length of the splice. Owing to the inability of gutta-percha to stand exposure to moderately high temperature, light and air, it has been the practice among European engineers to splice a piece of rubber-insulated cable on to the gutta-percha below the water level at the shore ends, and thus make the landing with rubber-insulated cable. As it is well-nigh impossible to make a perfect splice between rubber and gutta-percha, it is necessary to employ a water-tight junction box if this method of terminating the shore ends is used. No method has yet been found for cementing rubber and gutta-percha together so that the joint will hold for any appreciable length of time. The practice of using rubber insulation for the shore ends was not followed in laying the Point Grey-Nanaimo cable, for the above reasons. The shore ends have been buried from the terminal in the cable hut to low water, and on account of this, will not be exposed to temperature very much above that of the sea water. Sufficient slack has been left in the cable so that in case the ends at the terminals lose their insulating qualities, they may be cut off and the cable reterminated. In this way the ends of the cable may be kept in excellent condition by allowing a few feet extra for the cable reterminating.

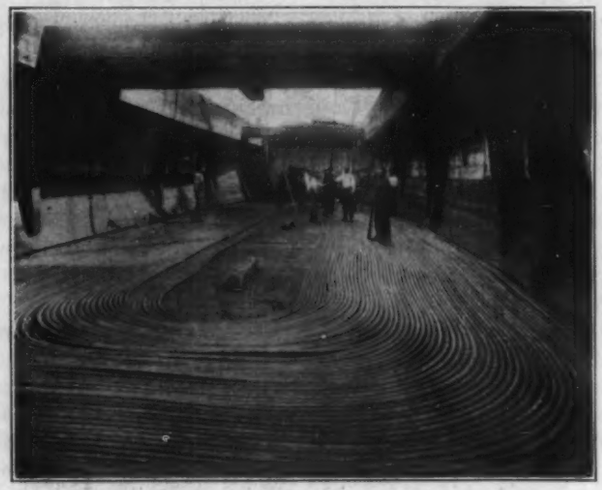
In a four-core cable, such as is generally used for telephone purposes in deep water, the two opposite cores are used to form each circuit. It is not necessary, if the cores are arranged symmetrically about the center, that the wires be twisted in pairs in order that each circuit will be unaffected by the current flowing in the other. The wires of one circuit do not interloop the lines of magnetic force from the other, and each of the wires is under the influence of equal and opposite electrostatic fields. This latter is not true of a cable submerged in salt water, due to the shielding effect of the salt water. As mentioned before, it will therefore be seen that the two circuits are quite independent of each other, both electromagnetically and electrostatically. The same thing is true of the superimposed or phantom circuit, but the results obtained in practice are not so good as with the two physical circuits.

In selecting a design of cable suitable for this service, the choice was practically limited to a four-core gutta-percha cable, loaded either by the continuous Krarup system, or by the use of Pupin coils. Owing to the depth of water (1300 ft. = 396 meters) a paper-insulated lead-covered cable was not seriously considered. The stress during the laying would so strain the cable in passing over the drums and sheaves that there would be great danger of impairing the insulation between the wires. Owing to the highly distortional effect of non-loaded gutta-percha cable, it was necessary to eliminate such a cable from consideration. It remained, therefore, to choose between the two types of loading. It is well known that a coil-loaded cable is quite superior to a continuously loaded cable, or, in fact, any other design of cable when electrical qualities alone are considered. The continuously loaded cable is mechanically quite simple, and upon its completion is equally as strong as a non-loaded cable, such as has been used for telegraph service for years, even at the maximum depth of the ocean. In a coil-loaded cable the only acceptable design of coil so far employed is one which surrounds the four cores of the cable, and which is taken inside the regular cable armor. This causes an increase in the diameter of the cable from two to three times its unloaded diameter, and in spite of precautions which may be taken in the manufacture, these loaded points are the weakest spots in the cable, both electrically and mechanically.

The two best-known examples of coil-loaded submarine cable extend from England to France across the English Channel, and from England to Belgium. The former cable is about 20 nautical miles (37.1 km.) in length, and the latter about 40 nautical miles (74.2 km.) in length. Neither of these cables is laid in a very great depth of water, and both are under the supervision of the British Post Office, which has avail-

able cable ships especially designed for the laying and repairing of such cables. The older of these cables has only been in use about three years, and during this time no serious case of trouble has developed, so that the actual difficulties to be encountered in repairing this type of cable can only be forecasted in view of experience in repairing the non-loaded type.

In order to keep the transmission in a coil-loaded cable at its original quality, it is necessary that the spacing of the coils be kept as originally laid out, allowing only a variation of five per cent. It is quite obvious that this is not true of the continuously loaded type, and any increase in the length would cause an increase in the transmission loss, only in proportion to the increased length of the cable employed.



Coiling of Cable in Hold of Princess Louise.

In case of a fault in deep water, the cable is picked up by means of a grapnel, and as soon as it is brought to the surface it must be cut in order to relieve the great strain. One end is retained in the grapnel and a line is made fast to the other end, which is thrown overboard and a buoy attached. The end which is retained is tested for the fault, and unless the fault is in the cable which was thrown overboard, the cable is picked upon until the fault is located and repaired. It is then necessary to splice in a piece of new cable and pay out until the abandoned end is picked up, when as much slack as possible is taken out and the two ends spliced together. It will thus be seen that a considerable additional length of cable will be introduced in case of a fault in very deep water. In case such a repair was made at a depth of 1300 ft. (396 m.), under the most favorable conditions, it is quite probable that 800 to 1000 ft. (244 to 305 m.) of additional cable would be introduced. As 300 ft. (91 m.) is the greatest allowable variation with coils spaced one nautical mile (1.854 km.) apart, it will be seen that the coil spacing would be badly disarranged and serious reflection losses introduced. It must also be remembered that no gutta-percha cable is manufactured in America, and the only submarine loading coils so far manufactured have been made in Europe, and in case expensive repairs were necessitated, it might be necessary to secure special equipment and skilled labor from Europe, while with the type adopted, repairs can be made with the equipment and labor commonly used in repairing telegraph cables.

Comparisons between the two types of loading have been made and much discussed by different authorities, and a comparatively recent paper on this subject by Mr. J. G. Hill summarizes arguments in favor of the two types in a very excellent manner. It is a well-known fact that the two types of cable having the same transmission efficiency may be produced, the coil-loaded cable at much less expense than the continuously loaded cable. Mr. Hill bases his comparison on two factors; one, that inductance can be added by the continuous method of loading only up to a certain limit, say 20 millihenrys, while by coil-loading any desired amount of inductance may be added to the circuit; and second, that the ratio R/L, obtainable with the coil-loaded cable, is much less than that obtained in continuous loading. The limit of economic loading depends upon the amount of resistance added to the circuit in increasing its inductance.

The attenuation constant of a cable is unfavorably affected by the addition of resistance. All known methods of increasing the inductance of a circuit also increase the effective ohmic resistance, and Mr. Hill compares the efficiency of the added inductance in terms of the amount of resistance so added. It has been found that the ratio between the added resistance and the added inductance for continuous loading is about 110, while a good design for loading coil has a ratio of R/L of about 60. These ratios are true only for the amount of inductance used in ordinary practice. The increase in effective resistance, as is well known, is due to the eddy currents and hysteresis losses in the iron of the magnetic circuit. Eddy current losses can be reduced by subdividing the iron. Hysteresis losses depend upon the degree of saturation of the magnetic field, which is kept low in all telephone circuits. Pupin coils employ a toroidal magnetic core composed of a large number of turns of very fine iron wire with some type of enamel insulation. It is possible to employ several layers of fine wire on a continuously loaded cable, and several have been laid which use three layers. The improvement in the magnetic circuit by such subdividing is not so marked as in the coils, and the expense is very much greater. It would seem that future design will show a still greater advantage in the coil-loaded type of cable, as it is probable that the R/L for loading coils can be reduced still more, economically. It might be of theoretical interest to remark that as the effective resistance of a coil-loaded conductor is a function of the frequency, it is therefore impossible to build a distortionless circuit employing iron magnetic fields.

We can therefore summarize the arguments that we considered in selecting the type of cable as follows:

Arguments in Favor of a Coil-Loaded Cable. 1. Could employ smaller conductors and less gutta-percha, and secure a cheaper cable for the same transmission equivalent (disregarding terminal losses).

2. Could give the phantom circuit the same degree of loading as the physical circuits.

3. Could add any desired amount of inductance.

4. Ageing of the iron cores of the loading coils could not unbalance the circuits.

Arguments in Favor of a Continuously Loaded Cable. 1. Simplicity of construction.

2. Could be laid and repaired like an ordinary gutta-percha insulated telegraph cable.

3. Short lengths added in repairs do not materially affect the transmission.

4. Not liable to faults at loading coils.

5. Faults could be located more accurately by means of resistance measurements.

6. Is not heavily loaded, and therefore has less reflection losses at shore ends where it joins to non-loaded open wire lines, than would be the case with a coil-loaded cable.

7. Known to be reliable at the greatest depth of water.

It was after due consideration of the above factors that the continuously loaded type was decided upon, and the results obtained have amply justified the selection.

"CAMP CO-OPERATION."

At the invitation of the Association Island Corporation, over one hundred and fifty guests, composed of representative men in the electrical industry and others not directly connected with the electrical business were invited to spend three days during the first week in September at "Camp Co-Operation." Association Island, located in Lake Ontario near Sackets Harbor, New York, has been used as a conference headquarters for some time by the manufacturers of incandescent lamps. The gathering was representative and the purpose of the meeting was to promote a closer co-operation among the various branches of the electrical industry and to discuss questions important to immediate future development.

The meeting was entertained on Wednesday evening in opening with motion pictures. the films for which were selected by Thomas A. Edison who was unable to attend the meeting in person. The pictures were illustrative of the idea upon which Mr. Edison is now working to turn motion pictures to educational uses. For instance, one film was, in itself, a course in elementary electricity and magnetism while another was a biological study of moth development.

Samuel Insull spoke briefly of his early association with Mr. Edison at Menlo Park and touched on the early cost of manufacturing incandescent lamps, a cost analysis for one month in 1883 showed that the expense of making each lamp was from $1.50 to $1.75, the retail sales price being 35 cents.

The session was formally opened by S. O. Richardson Jr., general manager of the Libbey Glass Company, and president of the Manufacturers' Club. Mr. Richardson welcomed the guests to "Camp Co-Operation" in behalf of the Association Island Corporation, and A. W. Burchard, vice-president of the General Electric Company, followed with a brief history of Association Island and explanation of the use made of it as a conference headquarters.

Joseph B. McCall, president of the National Electric Light Association, was chosen as presiding officer. As chairman of the meeting, he called on Samuel Insull, president of the Commonwealth Edison Company, for the first paper of the evening.

Mr. Insull, spoke on the "Distribution of Electrical Energy, Present and Future," tracing the development of the central station business and showing that the progress of electrical transmission is fully as important as transportation in the commercial advancement of a nation. The business of the central station has changed in the last few years from a lighting business to a power business. The central station which has merely a normal power business has only a load factor, at best, of approximately 30 per cent, while the central stations which have developed their power load energetically have raised their load factor to about 45 per cent. Only 25 per cent of the output of the Commonwealth Edison Company of Chicago is consumed in lighting load and while this company has more lighting customers than any other central station in the world it derives 47 per cent of its total income therefrom. In speaking of the future Mr. Insull said that the immense capacity generating units now available and the necessity for fuel conservation, made it certain that the production of electric energy would become concentrated.

Senator Willard Howland of Massachusetts delivered an address on "Government in Relation to Business." Senator Howland, who is also chairman of the Massachusetts State Commission of Conciliation and Arbitration, brought out particularly the fact that public utilities which were being operated with a view to giving the public the best service at a fair remuneration for the capital employed have nothing to fear from government ownership.

In the evening, Dr. Chas. P. Steinmetz spoke on "The Future Technical Development of the Electrical Business." He stated that it was only possible to judge the future from the present trend of the industry. We have at present 30,000 h.p. generators and it is evident that more economical production of energy will be possible with still larger units. It is certain that larger units will be built as soon as the demand requires. We now have electrical transmission at 140,000 volts for a distance of 200 miles covering from 10,000 to 20,000 square miles, so that the interlinking of great transmission systems is decidedly possible for the future.

The Mazda lamp of today gives five times the light of the first lamps manufactured by Mr. Edison for an equal current consumption and still greater advances along these lines are already forseen. The recent developments in electrometallurgy and in the domestic electric utensils give promise for the future. In closing, Dr. Steinmetz said: "The fact that electrical energy cannot be economically stored means that it must be consumed at the rate at which it is produced; it means that economy requires co-operation; consolidation in a big, nation-wide energy generating, transmission and distribution system analogous to our present railway system."

Hon. John H. Roemer, chairman of the railroad commission of Wisconsin, spoke on "State Commission Control." Mr. Roemer laid stress on the necessity for intelligent regulation of all public utilities. Both the utility corporation and the public have rights in which they should be able to expect protection. A great deal of trouble has arisen over the question of franchises. Unless a franchise is granted for a long period, there is little inducement for the investment of capital. It is almost impossible to clearly define the duties and restrictions which should govern a public utility corporation over a long period of time because of the changes time necessarily brings about.

The only solution which seems practicable is the granting of indeterminate franchises which may be revoked at any time provided the community pays what a fairminded tribunal shall determine to be the correct value of the property. The system of commission control removes the necessity for the utility to be a factor in local politics, does away with discrimination in rate schedules and prevents law suits and unnecessary duplication of machinery and material which the public must pay for when there is unnecessary competition between rival utility corporations. The Wisconsin commission particularly, has rendered valuable service in establishing uniform systems of accounting, inspection of equipment and settlement of rate disputes.

The next morning Mr. Frank Vanderlip, president of the National City Bank of New York, spoke on "The Financial Outlook." Quoting from his opening remarks "Four hundred millions a year, eight millions a week, of fresh capital can profitably be used in the development of the whole broad field of electrical industry in the United States during the next five years. What the calls for new capital might reasonably be expected to reach after five years, no one can predict with accuracy, but I believe that it is a conservative estimate to say that the intelligent development of the industry as a whole could absorb four hundred million dollars per annum for the next five years, if that amount were available for the purpose."

Mr. Vanderlip said that only one or perhaps two out of ten investors were at present willing to invest in public utilities. They do not yet trust the stability of the business and fear the present political tendencies. It is the duty of the bankers of the country to educate investors as to the certainty of a steady, fair return on capital which these utilities offer.

Mr. F. D. Fish, one of the foremost patent attorneys of the times, discussed "The Principles of Resale Control," reviewing the history of the disposal of commodities by the maker to the public. Less than a generation ago, every inducement was made to manufacturers and transportation companies by the community in order to increase the commercial activity of the country. From this public feeling, and the laws which followed it immense commercial enterprises have grown and with them immense fortunes in the hands of a few men. Public sentiment has changed and is now unfavorable to these very things which were the outgrowth of public opinion. Competition has become so keen that it is destructive and has forced manufacturers of similar commodities to combine and to agree on certain prices. The fixed re-sale price is the manufacturers defense against the cutting of retail prices.

Dr. Steinmetz made a very interesting comment on this paper, stating that the fixing of the re-sale price of a commodity eliminated competition, which elimination, contrary to popular opinion, is desirable because competition has ceased to be a progressive force in business and has become a destructive force instead. Dr. Steinmetz stated that "competition died on the day on which the advance of engineering had increased the means of production of a commodity beyond the maximum amount which could be consumed under the existing social conditions. Unlimited competition forces prices down not to the value of giving a fair profit above the cost of production but the dropping of price stops only where the loss in production exceeds the loss of having the industry stand idle."

J. Robert Crouse, read a paper regarding "The Society for Electric Development." Mr. Crouse outlined the wonderful progress which the electrical industry has seen in research and inventive development and compared it with the lack of progress in selling methods. The ratio of sales expense to the amount of sales is at present tending towards an increase instead of decreasing as it should.

Mr. J. M. Wakeman, general manager of the Society for Electrical Development, outlined the plans of the society.

Henry L. Doherty, president, Society for Electrical Development stated that the membership had reached four hundred and that $135,000 of the $200,000 required by the Society has already been subscribed.

Dr. Thomas Darlington, secretary of the welfare committee of the Iron and Steel Institute of New York, outlined the welfare work which is not being done by a great many corporations. Money spent in welfare work has been found to be a paying investment because of the better quality and greater quantity of work which results.

Frank W. Smith, vice-president, Electric Vehicle Association of America, spoke of the co-operative advertising campaign that society is now running for which $42,000 has already been spent and for which $34,000 is pledged for next year. Of the $42,000, fifty-eight per cent was contributed by central stations, 31 per cent by manufacturers of accessories and 11 per cent by vehicle manufacturers.

Norman Macbeth, vice-president, Illumination Engineering Society, pointed out the co-operative organization of the Illuminating Engineering Society. Less than one per cent of its members are actually professional illuminating engineers; electrical engineers, gas engineers, architects and designers of fixtures and glassware being numbered among its membership. This society is at present accomplishing much good through co-operation with other societies and educational organizations.

Mr. S. O. Richardson Jr. spoke for the Manufacturers' Club which was organized to give their members a broader understanding of patent laws, standardization of materials, welfare work, etc. The Manufacturers' Club is heartily in favor of the Society for Electrical Development because it offers a cheaper and better method of advertising.

Electrical washing machines are used by 25 per cent of the customers of the Pacific Light & Power Company in Pomeroy, Wash.

Water powers with an aggregate estimated capacity of 12,000,000 h.p. are available within the national forests for use under permit from the secretary of agriculture.

Erection of ornamental standards by use of the city steam roller has been economically accomplished by City Electrician Toal of Ely, Minn., who converted the steam roller into a lifting crane.

ELECTRICAL PUMPING AND IRRIGATION

THE SELECTION AND INSTALLATION OF A SMALL PUMPING PLANT.

BY B. A. ETCHEVERRY.

[Continued.]

First Cost of Plant.

The first cost of a pumping plant depends on the grade of machinery, the cost of transportation, the expense of installation. Because of these factors accurate estimates of cost cannot be given. However, the approximate cost values given below will be of value to the land owner who is considering the feasibility of a pumping plant. The values given represent the prices at the factory and do not include transportation and installation.

Approximate Cost of Single Stage Centrifugal Pumps.

No. of pump.	Capacity in gal. per min.	Cost.
2	100	$ 42
2½	150	51
3	225	57
3½	300	65
4	400	75
5	700	85
6	900	115
7	1200	145
8	1600	170

The cost of two-step centrifugal pumps of the same size will be about four times the values given above.

Approximate Cost of Triplex Single-Acting Power Pump.

Dia. of water cylinder. In.	Length of Stroke. In.	Capacity in gallons per min.	Height of Lift. Ft.	Cost.
4	8	65	75 to 100	$170
5	10	120	100	250
6	12	220	100	340
4	6	48	175	225
5	8	91	175	325
7	8	180	175	450
8	10	270	175	700
8	12	310	175	750

Approximate Cost of Electric Motors, Gasoline Engines and Simple Slide Valve, Non-Condensing Steam Engines, With Locomotive Boiler and Auxiliaries.

Horsepower.	Cost of electric motors, 1200 rev. per min.	Cost of gasoline engines.	Cost of steam engines.
2	$ 70		
3	85		
5	110	$375	$500
10	200	550	625
15	230	700	800
20	320	850	925
25	360	1000	1000
30		1200	1200
40	450	1600	1350

The above costs are for the pumps and engine, and do not include the accessories, the foundation, the labor or installation, and the housing. For an electric plant the cost of transformers should be added unless these are supplied by the electric company. The accessories will include the suction and discharge pipes, the valves and fittings, the priming pump, the connection between pump and engine. The suction pipe is usually made of steel; the discharge pipe may be steel or wood banded pipe and should cost delivered as follows:

Cost of Pipes Safe for 150 Ft. Head.

Diameter of Pipe. In.	Cost per Ft. Wood Banded Pipe.	Cost per Ft. Steel Pipe.
4	$ .20	$ .30
6	.30	.50
8	.40	.80
10	.55	1.10
12	.65	1.35
14	.75	1.60
16	.95	2.00
18	1.10	2.50
20	1.44	3.00

For a rough estimate the total cost of valves, priming pump, all fittings and suction pipe, but not discharge pipe may be taken as about 10 per cent of the cost of pump and engine for a gasoline or steam plant and 20 per cent for an electric plant. The cost of installation should not exceed 5 per cent. The cost of a building to house the plant will range from about $25 for a small plant to $100 or more for a larger plant. The cost of transportation and hauling will depend on the railway charge and on the distance from the station to point of installation.

Fuel Consumption and Fuel Cost.

The selection between a steam engine, gasoline engine and an electric motor will depend to some extent on the comparative cost of coal, gasoline and electrical energy.

A gasoline engine is usually guaranteed for a fuel consumption of 1/8 of a gallon per rated or brake horsepower per hour. A new engine well adjusted will come up to this efficiency, but an engine that has been operated some time will consume about 1/6 of a gallon of engine gasoline or distillate per brake horsepower per hour.

The fuel consumption of a steam engine will vary greatly on the type of boiler and engine. A small slide valve non-condensing engine under 25 h.p. will use probably 50 to 60 pounds of steam per brake horsepower per hour. A locomotive type of boiler should give 5 or 6 pounds of steam for 1 pound of coal or about .6 pounds of oil. Therefore, a small steam engine under 25 h.p. should consume about 10 pounds of coal per brake horsepower per hour or about 6 pounds of oil. Steam engines of the same type from 30 to 50 h.p. will consume from 8 to 5 pounds of coal per brake horsepower per hour or from 5 to 3 pounds of oil.

Electrical energy is measured in kilowatts. A kilowatt is equal to one and one-third horsepower, but because of the loss of energy in the motor, 1 kw. will usually give about 1.1 brake horsepower. Based on this figure 1 brake horsepower is equal to .9 of a kilowatt hour.

The above values show that to produce 1 brake horsepower per hour requires either 1/6 of a gallon of distillate, about 10 pounds of coal, or 6 pounds of oil for a kilowatt hour. Based on these figures the table below shows the cost of fuel per brake horsepower per hour for several equivalent cost values of fuel. In the table is also given the fuel cost of pumping one acre foot of water through one foot of lift, assuming plant efficiency of 50 per cent and 75 per cent.

Cost of Fuel per Brake Horsepower per Hour.

Equivalent unit costs of fuel. Cost of gasoline in cents per gal.	Cost of crude oil per bbl. (335 lb.) in dollars.	Cost of coal per ton in dollars.	Cost of electric per kw.h. in cents.	Fuel cost (in cents). Per brake h.p. per hour in cents.	Per acre ft. of water lifted 1 ft. high. 50% efficiency.	75% efficiency.
6	$ .55	$2.00		1.00	2.75	1.83
8	.75	2.66		1.33	3.70	2.45
10	.93	3.33	1.85	1.66	4.60	3.05
12	1.12	4.00	2.22	2.00	5.50	3.65
14	1.30	4.66	2.60	2.33	6.40	4.25
16	1.50	5.33	3.00	2.66	7.30	4.90
18	1.67	6.00	3.33	3.00	8.25	5.50
20	1.85	6.66	3.70	3.33	9.15	6.10
22	2.05	7.33	4.10	3.66	10.10	6.70
24	2.25	8.00	4.35	4.00	11.00	7.35
26	2.42	8.66	4.80	4.33	11.80	7.95

Fixed Charges and Attendance.

A. Fixed charges.—The cost of installation represents a capital which if invested would bring in an income represented by the interest. It is therefore necessary to consider this interest as part of the cost of operation. To this should be added the annual cost of repairs, maintenance and renewal. These items of cost represent the fixed charges. After 6 or 8 years a gasoline engine may need to have its cylinder rebored and a new piston provided, the cost of which is about one-fourth the cost of a new engine. With ordinary care the life of a gasoline engine may be taken as 10 years; the life of an electric motor about 15 to 20 years. The fixed charges on the entire plant may be taken as follows:

Fixed Charges.

	Gasoline engine Plant.	Electric Plant.	Steam Engine Plant (Small).
Depreciation and renewal	8%	5%	8%
Repairs and maintenance	3%	1%	2%
Interest	6%	6%	6%
	17%	12%	16%

B. Attendance.—An electric motor requires a minimum of attendance, small gasoline plants require frequent inspection, and steam engines require considerable attention and usually cannot be economically used for small plants operated during short periods. The cost of attendance for an electric motor pumping plant should not exceed 5 cents per hour, for a gasoline engine plant 10 cents per hour, and for a steam engine plant 30 cents per hour. While electric motors and gasoline engines are usually operated by the orchardist or irrigator, his time is valuable and a charge should be made for it.

[To be continued.]

Safety at sea.—Secretary of Commerce Redfield's Committee on Aids and Perils to Navigation to prepare recommendations for the use of the American delegation to the London International Conference on Safety at Sea has made its report, recommending among other things, that all ocean-going steamers, equipped with electricity, shall carry a searchlight so placed as to illumine all points of the horizon as far as practicable, and of sufficient power to distinguish a ship's 20-foot boat at a distance of not less than 1 nautical mile on a clear dark night. That all light vessels on important outside stations shall be equipped with submarine bells, and all ocean-going vessels shall be provided with means for detecting submarine bell signals. The committee recommends that the international rules of the road be modified so that carrying of range lights shall be obligatory instead of optional, as at present, and that all vessels shall carry a fixed stern light.

The application of radiotelegraphy to the collection of weather reports from oceanic areas gives promise of securing to navigators a greater measure of safety from the perils of the sea than has hitherto been possible. Such a service necessarily would be international in character, the expense of which should be shared jointly by the nations most directly concerned. The committee recommends, in the interests of the future development of radio-meteorological services, that the existing meteorological service of each administration adopt as part of its program the organization of a radio service for the coastal waters pertaining to that administration.

PUBLIC SERVICE RATE-MAKING.

BY ALEX C. HUMPHREYS, M.E., Sc.D., LL.D.

(Although actually a discussion of a previous paper on the determination of gas rates, a consideration of the viewpoint presented by Dr. Humphreys should prove of interest to all public utilities. This paper was read before the Pacific Coast Gas Association convention, 1913, and the discussion is also included.—The Editor.)

In choosing the subject for this paper I have had in mind the definite purpose of discussing the paper by C. L. Cory, entitled, "Reasonable Gas Rates and Their Determination," presented at the 1912 meeting of this association.

While I find in Mr. Cory's paper some grounds for agreement with him, I find other grounds for material disagreement. Much of what I shall have to say will also be applicable to public service other than that of gas supply.

In accepting Mr. Cory's statement that the "storage of gas in large gasholders * * * eliminates, to a considerable extent, the necessity of providing a manufacturing plant proportional to the maximum demand, as must be done in most electrical generating stations," we must keep in mind that he is referring to the hourly maximum demand. In this particular the gas plant has a marked advantage over the electric light plant. But in connection with what is to follow, we should bear in mind that it is not good practice to design or even depend upon a gas manufacturing plant which has a capacity less than the maximum daily demand. In fact, in designing such a plant we should expect to provide a capacity considerably in excess of the expected present maximum daily output. Certainly, if our maximum daily output has reached the safe manufacturing capacity, no time is to be lost in adding to that capacity.

Under certain circumstances it may become necessary "to install an automatic pressure regulator for each customer," but it by no means follows that this will obviate complaints or prevent "variation of pressure at the gas consuming devices." Especially in high buildings and where the governor is installed in the basement there is full opportunity for variation in pressure after the gas has passed the governor. The governor also adds one more mechanism to be kept in order, and frequently is the breeder of complaints.

Unquestionably, the best possible service should be given to the customers. It does not follow, however, that the service given is faulty or inadequate because complaints are made. Every complaint should be investigated and faults should be corrected promptly and completely, and employes who repeatedly fail in this regard should not be retained in service; but this will not completely eliminate the complainer. As long as trade exists between human beings, there will be both cause for complaint and complaint without cause.

I am sorry to get the intimation through Mr. Cory's paper that there are gas managers on the Pacific

Coast who are still treating their customers so brutally as to warrant their subjection to such tortures in Hades as Mr. Cory so graphically describes. It may be that "The wide variation in gas rates in the different cities of the Pacific Coast" is at least in part due to the men who are past due in "the bottomless pit of Hades."

Control of public utilities by public service commissions is a fact and we must make the best of it. A fair and able commission operating under a fair law may perform a great service for the public utilities and those they serve. But let us not use as one of the arguments in favor of public service commission control that we thus avoid "The so-called regulation of rates and service directly by inexperienced though well-intentioned (?) municipal or county (or state) officials elected by the people." Whatever may be the fact on the Pacific Coast, public service commission control has not in the East eliminated "strike" legislation.

While speaking of regulation by public service commissions, let me say that their powers should not include the three functions of government which should be kept separate and distinct according to our American ideals and traditions—namely, the legislative, the executive and the judicial. In some cases the commissions have exercised all three of these functions, and this must be corrected if our form of government is to be maintained.

I am glad that Mr. Cory has quoted from the sane report of the railroad securities commission, of which President Hadley was chairman. It is a pity we cannot get more of this kind of advice to place before our legislators.

I am glad to agree completely with Mr. Cory in his statements as to the risks accepted by those who engage in public service enterprises. This is something which is almost, if not completely, ignored by the man in the streets, and we are today largely governed by that man. Mr. Cory's enumeration of some of the hazards to which public utilities are subject is most timely. I would not, however, confine the risks to the smaller companies. I am moved also to add at least one item to the list: the cost of defending actions against the utilities in courts and before commissions.

I must confess I have not noticed to any great extent that "the tendency of public service commissions and of courts has been towards allowing higher rates of return than were at first regarded as sufficient for a public utility to earn." From this statement I presume our friends on the Pacific Coast are to be congratulated.

I think that Mr. Cory's warning against the use of the term "deficit" in connection with "development expense," is most apt and timely. The questions involved in "going value" as separate from the other elements of value in a going concern, are, at the best, complex and difficult of complete explanation. Certainly our difficulties should not be magnified by the use of misleading terms—a fault which is much in evidence in this day of "reform."

Having cleared the ground for a concrete example, Mr. Cory says, "I have compiled some data and figures upon a gas plant and system which I will say frankly has no physical existence so far as I know." The following pages, however, treat the questions involved as if it there were a specific gas property under analysis. For instance, page 21: "From 1905 to 1912, records were available so that these curves could be compiled." Were the records of an imaginary plant available or does Mr. Cory refer to the average of a number of records? Then follows a curve diagram which is explained and interpreted in detail as if based upon facts. For instance: "On June 30, 1907, there was very little difference in the number of services, meters, and consumers respectively, but two years later there were many idle services and meters, which again is not a good business situation for a gas company." I confess I am unable to understand what we are considering. Is it data that can be supported or is it guessing?

But let us consider some of the data or assumptions included after the title: "Practical Illustration in the Determination of Gas Rates."

The unaccounted for gas ("Leakage") is taken as 11,000,000 cu. ft. or about 300,000 cu. ft. per mile, not reduced to uniform size of pipe. The 15.5 per cent indicates a high "leakage," but of course this is not conclusive. The 300,000 cu, ft. per mile is conclusive to the effect that the unaccounted-for is far higher than represents good average practice.

It is stated that because of the locality a higher rate of return is rightfully to be demanded than if the plant were located in the East, and then 8 per cent is taken as the fair rate of return. Certainly not less than 8 per cent should be demanded in the East.

The "going value"—apparently here assumed to be the cost of developing the business and not the total value as a going concern—is assumed to be only "about 10 per cent of the total value." This is an extremely low estimate and one which it would be most unsafe to follow in the great majority of cases.

Having assumed that the output is 71,000,000 cu. ft. per year and the sales 60,000,000 cu. ft., the cost, including depreciation, plus return of 8 per cent, is taken as $1.40 per thousand cu. ft. It is then stated that it is not proper to conclude that the proper rate to be charged is $1.40 per thousand, but the sales should be increased to 84,000,000 cu. ft., the cost plus return on investment to remain as before; namely, $84,145. This indefensible assumption is vital to the author's main proposition.

The author has already shown that there is a cost for the taking on of customers, though he sets this cost at the low figure of 10 per cent of the total value, or say $36,250, or about $13 per consumer. Will it cost nothing to secure the additional consumers and to induce those already on the books to increase their sales? Allowing fully for the fact that the expenses will not increase directly with the increase in output, will it cost nothing to manufacture and distribute the additional 24,000,000 cu. ft.? Is it at all likely that this increase can be obtained without creating a demand beyond the established system of mains, and will the additional mains cost nothing? Unless all the increase is to come from increase in sales to the present consumers, will the additional services and meters cost nothing?

But beyond all these considerations, which need only to be mentioned to negative Mr. Cory's proposition, there is an assumption which is most fallacious. Apparently the author assumes that the manufactur-

ing plan and distributing system have surplus capacity, and that this surplus capacity can be utilized for increasing the sales without additions to the plant. As to mains, services, and meters, I have already raised the question whether the sales could be increased 40 per cent without taking on new consumers. Now as to the manufacturing plant:

The manufacturing capacity should be based upon the maximum day's output, with a liberal margin for emergencies and increases. Certainly no engineer or manager would for a moment contemplate deferring his extensions until the maximum daily demand had reached or nearly reached the manufacturing capacity. This means, then, that unless there is an excessive surplus of manufacturing capacity, the increase in sales, as a general proposition, requires an increase in investment for manufacturing. We may, perhaps, be able safely to utilize a portion of our excess capacity, but when the time comes to extend, we must extend to cover the margin of capacity as before. In other words, it would not be practicable or economical to increase our manufacturing capacity year by year to meet exactly the yearly increase in output, so we have to make these extensions to cover the increase of a number of years. But this by no means implies that any one or two or three years can have the benefit of their proportion of the excess capacity without paying for it. If this were legitimate accountancy we might with equal force say that the years should not carry their share of the accrued and accruing liability for final renewals—generally known, and unfortunately so, as "depreciation." When our increased sales are absorbing our surplus manufacturing capacity, we are making a temporary gain on investment return; when we come to the time for extending the plant, we experience a corresponding additional burden on investment return. To spread this burden equally, then, we disregard the temporary advantage which Mr. Cory's presentation of the case indicates as a permanent advantage.

Looking back over my experience of many years, including operations, investigations and hearings, I can think of no statement more dangerous and misleading than the one now under discussion—namely, that the sales can be increased 40 per cent "without materially increasing the investment required." Even if this claim had been proved or were demonstratable, nothing is said by the author about the increase in operating expense, as previously referred to. For instance, the amount of oil used would increase directly, and so this item would increase from $14,300 to $20,020.

Near the end of his paper, Mr. Cory says: "The fixed charges in the manufacture of gas bears such an important relation to the total cost of manufacture that increasing the amount of gas made in a single plant very materially reduces the total cost of the gas delivered to the holder." It cannot be that Mr. Cory really means that by increasing the amount of gas manufactured and delivered "the total cost" is lessened. We may presume that he means that the cost per thousand would be reduced. But even if we give him the benefit of this doubt, it is apparent that he has fallen into error; an error all too prevalent with those partly informed. If, for instance, a comparison of costs were made as to two companies operating under conditions as nearly similar as possible, one selling 60,000,000 cu. ft. a year and the other company selling 84,000,000 cu. ft. a year, the difference in cost per thousand would be found hardly to deserve the designation "material."

We now come to a point which should be considered in all rate-making investigation—namely, that the carrying of each customer on the books of the company is a continuing expense to the company, independent of the amount of gas sold to and paid for by the customer. A large proportion of the gas customers carried on the books of the gas companies of the United States are a source of final loss to the companies. In other words, the profit on the gas so sold is not sufficient to offset the fixed losses referred to. This fact is well recognized by all who have given the matter competent study, and this has been recognized in many papers which have been read before our gas association. Further, it has been recognized in gas rate schedules put into force, and still more often in electric light and power rate schedules. This condition was met in a rough way by the charge formerly made for meter rent. But the term became obnoxious and so the charge was eliminated by legislation, notwithstanding its fundamental justice.

The fact that each gas customer places an item of operating cost upon the gas company should alone have prevented Mr. Cory from assuming that the gas sales could be increased 40 per cent without adding to the total of operating cost.

One of the most important features in rate-making cases before commissions and courts is referred to in a very few words in Mr. Cory's paper—namely, the determination of the present value of the property as a whole. Generally, the rule followed has been the cost to reproduce, and in many cases it has been contended by the parties opposed to the public utilities that from this cost to reproduce new there should be deduced the accrued "depreciation." Further, it has been contended that this "depreciation" should be estimated on the basis of the "average life" of the plant and the age as found of the several parts of the plant. Further, it has often been claimed that the "average life" should be determined by reference to life tables based upon averages.

Not only have the commissions and courts been inclined to accept this claim, but too often the representatives of the companies have failed to oppose this claim adequately.

The question of "depreciation" is far too large a subject to cover in this paper; to do so would tax the patience of this audience. For the 50th anniversary of the Institution of Gas Engineers of Great Britain, held in London last June, I prepared a paper on this subject and I now quote the abstract of this paper and I attach hereto as an appendix the complete paper. The abstract is as follows:

"Depreciation"—Estimated and Actual.

This paper, lengthy as it is, does not pretend to answer exhaustively the complex questions involved.

An abstract, then, can do little more than develop the questions and suggest the answers.

Much that is contained in the paper has particular reference to conditions found in the United States; not a little is of general interest and application.

First, it is necessary to differentiate between estimated "depreciation" to accrue, to be included in the annual statements of operating expense, and actual "depreciation" as found by present appraisal.

It is also to be borne in mind that the term "depreciation" is a term often loosely employed.

It might be better if the expenditures to compensate for "depreciation" were classified and described as repairs, current renewals, and final renewals. When the first two are charged against current income as paid, estimated "depreciation" might better be known as final renewals.

This last item is of interest only in connection with the purpose to determine and set out the true and full annual operating expense, which should include all liabilities chargeable against the year's operating expense.

The necessity for such an estimate and charge is modified or eliminated when the charges for final renewals, as represented by the yearly expenditures, are found to be fairly uniform.

This means that the estimates on "depreciation" to accrue is made for the purpose of spreading as uniformly as possible over the life of the several parts of plant the cost of their renewals.

This is desirable from the accountancy and financial standpoints so that the profits may be shown as accurately as possible, that the returns on capital may not be inflated, and that the capital may be safeguarded.

It must be constantly borne in mind that this annual charge is based upon an estimate, and that the basis for the charge should be subject, year by year, to correction as experience, general and local, is gained.

In estimating "depreciation" to accrue, account should be taken of the following three elements: Physical decay, obsolescence, and inadequacy.

Actual "depreciation" should not be determined or estimated by the test of tables of average life and ascertained age of plant; but by expert examination of the plant as it stands, taking account of physical decay, obsolescence, and inadequacy.

An estimate made in advance, and especially when based upon averages, should have little standing in face of the facts as they exist.

Actual "depreciation" is to be considered from two standpoints:

It is to be assumed that the plant is maintained in a condition of high service efficiency. The case of a broken down or inefficient plant is not under consideration.

In any case, the "depreciation," or accrued cost of final renewal, should be treated as a liability resting upon the owners.

Hence, in a rate-making case, the public service corporation being under the control of governmental authority, estimated or appraised "depreciation" should not be deducted from the appraised cost to reproduce new. The public service corporation is under obligation to renew the parts of plant as required to maintain efficiency of service. The quality of service is the test.

If "depreciation," in such a case, is deducted, the result is that year by year to the end of the so-called "average-life" the appraised value of the plant, based upon cost to reproduce, is reduced until the value vanishes just before the end of the "average life." In this case there would be no investment in plant on which to claim a "fair return." An absurdity on its face.

This contention in no way conflicts with the proposition that, in case of purchase and sale of the property, allowance should be made for "depreciation." In this case the deduction is made in favor of the purchaser and the purchaser in turn assumes the liability for the cost of final renewals.

Many other points are incidentally covered in the paper. One is—the question as to the right of the owners to include in the plant appraisal the cost of pavements laid subsequent to the installation of mains and services. A decision of the appellate division of the supreme court of New York, rendered since the writing of this paper, supports the claim that the public service corporation has the right to include this cost in the appraisal of plant, notwithstanding the fact that the pavement cost was met by the municipality. This decision also supports the claim for "Going value.". (End of Abstract.)

Mr. Cory appears to hold that unless a depreciation fund is established, a deduction should be made from the reproduction cost, and the return should be based upon this reduced property value. As I have said, this agrees with the present views of too many engineers and with many commissions and court decisions. And yet I hold to the contrary.

In the first part of his paper Mr. Cory has laid stress on the quality of service. He has shown that this service efficiency should be required of the public utilities and that the regulating authority should enforce this demand. This being the case, and the public utilities being held liable for the accrued cost of final renewals, no deduction for accrued "depreciation" should be demanded or allowed, so long as the efficiency of the plant is maintained as evidenced in the quality of the service. The cost of repairs, current renewals, and final renewals ("Depreciation") all are to be included in the operating cost, and so long as these items are not recapitalized, there is no valid claim for deduction from the cost to reproduce.

In conclusion let me summarize the items which should enter into an appraisal of a gas property.

Valuation of Property and Business.

As of (date).

(a) Preliminary development, including legal expenses, preliminary canvassing, preliminary engineering, investigating real estate values, financial reports, preparation and other expenses of prospectus and incidentals; also permanent organization during construction, including salaries of officers, clerks, timekeepers, superintendents, inspectors, etc., rent, telephone, legal expenses and all other administrative charges, with interest.....$

(b) Real estate without improvements .....

(c) Interest on item (b) at rate of (?) per cent for the full period of (?) years during construction.....
The real estate would necessarily be purchased in advance of the construction period.

(d) Construction and equipment of works and distribution system as per detailed estimate.....

(e) General contractor's compensation, including his expense and profit, (?) per cent on item (d).....

(f) Engineering (?) per cent on items (d) and (e) covering plans in detail, general engineering oversight and inspection, including organization of engineering department .....

(g) Casualty and fire insurance (?) per cent on item (d) .....

(h) Taxes during construction period .....

(k) Interest during construction period of (?) years at rate of (?) per cent on one-half the sum of items (d), (e), (f), (g) and (h) .....

(l) Stores, supplies and working capital .....

(m) Cost of developing business at (?) per dollar of income on basis of estimated income from gas sales during year beginning (date), amounting to (?) .....

Total value of property and business, not including financing or franchise .....$

(n) Financing on (?) per cent basis .....

Total value of property and business not including franchise or easements .....$

Discussion.

President Vance—Gentlemen, you have heard the very excellent paper prepared by Doctor Humphreys of New York. I am going to ask Professor Cory to open the discussion of the paper.

Professor Cory—I am grateful for the frank approval as well as the straightforward criticism of Dr. Humphreys upon the matters pertaining to the valuation and control of the public utilities which I know has interested all of us, and to which I have given quite a little attention as a member of this association during the past two years.

In considering Dr. Humphreys' paper and his analysis of the paper persented before this association a year ago by myself, I feel that I am not unlike a Japanese boy who was employed in the Cory household for a number of years. At one time while away upon a vacation the care of things at home was left in the hands of this Japanese. Among other things placed in his charge was a pet horse, the proper feeding and care of which was of some concern to the family.

This Oriental was especially a student of English and English literature; in fact he had not a little ability in speaking as well as writing English, and letters that he wrote us while on our vacation were constantly a source of much interest. One of my friends during our absence had a habit of calling around to see how things were, and in telling us of the visit of this gentleman in one letter the Japanese boy said:

"Mr. ——— came the other day and said that 'Babe' was in very good condition, that she was not being fed too much, although she needed a little more exercise, But"; and then the Jap stopped and between hyphens made this rather classic statement: "I have studied the English language sufficiently to fully appreciate that the English word 'BUT' is destined to play an important part in introducing disagreeable thought."

Dr. Humphreys' work and his writings for many years have been of such constructive value as to make us all the more appreciate his paper written for this association. I am indeed glad to find that in any presentation of this subject by myself as a member of this association Dr. Humphreys has found something of sufficient merit for his fuller discussion.

I have but a few words to say in connection with some of the points he has brought out. I fully agree with Dr. Humphreys that the regulation of public utilities by what he has called "strike" legislation is most unfortunate. In my paper I may have exaggerated the inability of many municipal officers to cope with the rate fixing problems, but I do not hesitate to say that I have no use whatsoever for any representatives of the people, I care not who they may be, who feel that it is possible for a single commission or group of individuals to occupy the manifold relation referred to by Dr. Humphreys wherein their investigations and decisions embrace legislative, executive and judicial action.

The government of nations, states and cities is so divided as to make such a combination impossible. To those of us who have given very careful and serious consideration to these matters and have made every effort to get the facts in the case have good reason, I think, to resent a decision or conclusion on the part of commissions or other controlling bodies that may even have a semblance of what Dr. Humphreys calls "strike" legislation.

Further, such a decision is many times merely a poor compromise rendered only because a decision of some character is considered necessary, even though proper information and facts are not available. Such decisions are not constructive, they stand but a short time, and do more harm than good.

In reference to the risk under which public utilities, whether gas or other companies, conduct their business, in my paper I did have in mind especially the hazards of the business of a small gas company. There certainly is a risk as Dr. Humphreys points out even with large companies, but I have especially been impressed, and I dare say that many of you here today have been equally interested in many instances, where a small city has been practically wiped out due to a cessation of the principal business of the community or a change in the routing of the main line of a railroad. Such risks as these do not usually menace the public utilities of a large municipality.

Dr. Humphreys questions whether the gas company referred to in my paper was a real operating company or an aggregate of assumptions upon which a considerable amount of guessing was indulged in. In my experience on the Pacific Coast I have become familiar with the details of the construction and operation of a number of gas companies, and I can assure Dr Humphreys that the particular conditions outlined in the illustration used in my paper a year ago represent real and not imaginary conditions. The particular illustration came so near representing a specific company on the Pacific Coast that in discussing the paper one gentleman frankly stated that the figures given very nearly fitted the particular company over which he had entire supervision.

No particular situation is usually duplicated in very many gas companies when we come to the discussion of the intangible asset usually called "going value." No specific case can ever be applied to another case. In a community which is growing rapidly and complete service given it is apparent that the "going value" for such a public utility will be decidedly greater than in another community that has not changed in size within a considerable period of time. "Going value" should not, in my opinion, be expressed in a per cent of the physical value. Nevertheless in this particular instance using ths ordinary methods of determining "going value," it happened to approximate 10 per cent of the physical value. On the other hand I have known of some companies where the going value might be as much as 100 per cent of the physical value, and it would be absurd to assume that the going value of one company can necessarily be applied to an entirely different company operating under different conditions.

Probably the most important criticism of Dr. Humphreys was in relation to my reference to the possibility of increased sales of gas. I am strongly

of the opinion that it is possible to increase the consumption of gas per meter installed if the quality of service and rates are maintained so as to be advantageous to the consumer. You may remember at our last convention instances were cited where, by the addition of industrial appliances, the amount of gas sold per meter was increased 50 per cent within a three months' period, and this increased consumption does not always mean that you have to increase your plant and your distribution system in proportion. You of course will have to pay for fuel in order to make the increased quantity of gas, but there are many items of cost which will not be materially increased if additional sales of gas can be made, particularly to manufacturing companies.

Dr. Humphreys' criticism is of course in order and proper if increased sales invariably result in a proportionate increased investment, but when the Ford Motor Car Company adopted gas exclusively in its manufacturing plant such increased sales by the gas company certainly did not involve an increase in the investment of the gas company in proportion to the increase in sales, and the price of gas usually will very materially affect the magnitude of the increase in the amount of gas sold per meter installed.

In my paper I of course had in mind the reduction in cost per thousand cubic feet of gas, and not a reduction in the gross cost of the gas where the amount of gas sold was materially increased. It would be ridiculous to assume any other interpretation of the matter.

It is true that, in my paper last year, I mentioned very briefly many of the matters pertaining to the making of a valuation of a public utility for the reason that a previous paper presented to the association at its convention in Oakland in 1911 gave a more complete discussion of this phase of the regulation of rates.

Depreciation has been so fully discussed by Dr. Humphreys that any contribution by him to this important matter cannot but be of great value. I certainly did not intend to convey the idea that at any time a plant may become so depreciated that it has no earning value whatsoever as long as it is capable of giving satisfactory service. I quite agree with Dr. Humphreys that unfortunately in many instances in the determination of rates an erroneous interpretation of depreciation has been applied in many cases.

As illustrating what seems to me to be the fairest attitude towards the annual depreciation as well as the depreciated value of the plant of a public service utility, let us suppose that a man builds a house which is to cost, we will say, $10,000, and agrees with a tenant that the latter is to pay a rental which will give the owner a net return after taxes, insurance, etc., are paid, of 8 per cent. The tenant certainly has no right at the end of five years to take the position that the roof of the building has but a life of ten years and therefore demands a decrease in rent because the roof has deteriorated 50 per cent. As long as the roof of the house fully serves its purpose that is all that can be required, but the owner must not forget that at the end of ten years his depreciation fund should be sufficient to put on an entirely new roof.

This illustrates the point, I think, that Dr. Humphrey is driving at, but in the past it has been extremely difficult to get some of the rate fixing boards to look upon the word "depreciation" as anything other than a "bogey" set up by the public utility managers in order to impose upon the people a higher rate for service than is justified by the investment.

The time is ripe, however, for the most careful analysis of depreciation and such an analysis has been most carefully and accurately worked out by Dr. Humphreys, and his writings can be followed without question by those desiring a proper interpretation of depreciation, particularly as applied to gas plants. It is a fine thing then that we of this association have the chance to study an abstract of his classic paper.

Finally, I wish to say that the outline or details of items which should be considered in making the valuation of a public utility gas system as presented by Dr. Humphreys should be of very great use to the members of this association. Experience particularly in these latter times fully indicates it is difficult to cover all the items of cost entering into the conception, organization, construction and operation of a great public utility, and the more data we can get the more accurately will the figures be which are used as evidence of the present value of such public utilities.

Mr. E. C. Jones—I feel that our opinions as gas men are formed by our geographical location and by our local traditions. Doctor Humphreys was brought up in the gas business where every retort had specific dimensions, receiving a certain amount of coal every five, four or three hours, and produced its given quota of gas, not more and not less. And when the introduction of water gas made gas making easier, the capacities of water gas generators were so nicely calculated that a million foot generator meant a million feet in 24 hours of production capacity. One of the traditions of the gas business in the east where I was brought up and received my early training under those hard old masters, was that a gas company in all its expected prosperity might increase its sales of gas double in ten years. Now, to get to the question. We have on the Pacific Coast a new method of making gas—oil gas. We have generators whose capacities have never been tried till quite recently. We have traditions brought about by earthquakes, fire and the rapid growth of a new country, where instead of getting a doubling of our business in ten years we have had increases of 400 per cent in five years. We have been forced within the last four months by strike conditions to greatly exceed the rated capacity of all gas generators. Now, if Doctor Humphreys could come to California and find out the conditions under which we are operating and the conditions with which Professor Cory is familiar, he would most certainly agree with Professor Cory. I am glad, gentlemen, that this paper has been so ably discussed by Professor Cory and in such a nice spirit.

President Vance—I am going to call on W. E. Barrett of Los Angeles to discuss this paper of Doctor Humphreys.

Mr. W. E. Barrett—The president seems possessed to pick on little men. Why he should pick on me I don't know. I came here a very inoffensive citizen without any intent of creating any disturbance whatever.

I suppose because President Vance thought that I had some years ago been a subordinate of Doctor Humphreys, that I might have imbibed some of his ideas. It is absolutely untrue. I have got some of his thoughts.

We are face to face with a very serious moment in the life of our public utility. In the first place we are divided between two sets of conditions. First, if we wish to spend money we must apply to the state railroad commission for authority to spend it. It is based on what we are doing today and our income today, without any sign of warning or without any consideration apparently from the purely arbitrary standpoint the local rate-fixing body, which has no dependency on the rate-fixing commission, fixes our rate of income for the next year, after we have made our expenditure, regardless of what we have done with that money and without any investigation or consideration. The result is that a rate is fixed at such an arbitrary point that we are thrown into legal controversy.

We get down to the point where we must consider the income to meet the necessary demand. The mistake of most companies that I have met for the last twenty-five years, and which I have seen from an examination of some eight hundred of the different gas companies of the United States, is that they provided no adequate depreciation or no adequate provision for replenishment of their property. The result is that we come down to the present time and we come before a rate-fixing body and we ask for what is commonly called depreciation—a very mysterious term, as Professor Cory and Doctor Humphreys have both shown. It is a very difficult matter to explain what depreciation is. The judicial body will say, "The property is maintained and kept in first class working conditions. Where do you get your depreciation?" We draw a life-line, which, as Professor Cory states, comes to a conclusion sometime; and yet we have a property complete with all its functions and we have no investment. Necessarily on the face of such a proposition it is false. We must get at it a different way, and the determination of an item of that kind, as Doctor Humphreys has stated, gives us an opportunity to get a correct way to get the income to cover those present necessities. In a case which I have just been through the procedure of the other side was to set up a life-line of the various parts of the property, carrying it out to a certain point for a number of years, estimated, naturally, at a guess, set up an annual rate upon that basis, deducting from the original estimated replacement value, an amount which they term scrap-value, which left a certain residuum. Upon this residuum the rate of income was supposed to be fixed—not upon your investment but upon perhaps 80 to 85 per cent of your investment, upon which you were to be allowed a return. That is manifestly absurd. You would never be able to recover 100 per cent of your property. It is physically impossible to start on an 80 per cent basis and recover a hundred per cent when you have only 80 to start with.

Furthermore, in considering as an additional portion of the total property what some are pleased to call a going value, which covers a multitude of sins in the early history of most companies, and which has been undertaken to be capitalized many times, we also run against the difficulty from the financial end of the situation which we always at all times have to recognize. With the man who has money invested in the property, the return on the investment is like chewing the bag string of the pudding for proof. We must return the investment at some time with interest. The mistake has often been made of sapping a property into earnings to its very last minute, pocketing the earnings in dividends or extra dividends, to the point where the property reaches a condition where necessary extensive replacements or repairs must be made to maintain the proper continuity of service and provide for proper increase. What is the result? The present owners back gracefully out of the ring, taking their hats with them, leaving the ring for some one else to climb into at an apparently depreciated price, where 150 or 200 per cent has been recovered in a very reasonable space of time before that. The new purchaser takes the property, assuming practically all of the outstanding obligations which would amount ordinarily, say, to 100 per cent of the original property or more. He plasters another 100 per cent on top of that and comes back and asks for an earning capacity of 200 per cent and proceeds to carry out the same methods, backs out gracefully when he gets all he can get out of it, and the third party steps into into the ring, and does it over again. Those conditions have all in the past been practiced. There are lots, perhaps, that have not gone through that course. But public opinion has gotten to the point where that is the regular procedure of all public utilities. It is not the fact. There is at all times the man behind the gun, the engineer or operator, who has to stand there and deliver the goods. He gets up against it severely by having to deliver from the same original stuff, the same contribution of nature, an amount to supply an income on two to three hundred per cent of value where he was doing or could do splendidly on 100 or 150 per cent. A man might buy a piece of real estate and sit down and pay nothing other than his taxes. A neighbor buys a piece and puts on a large fine building. The other piece would increase in value by it. A public utility cannot do that. A man is entitled to the result of his efforts. There is a certain amount of stock issued. At the time it is issued it is worth nothing. After a period of 10 years, by steady, consistent application of effort, that stock is brought to an earning capacity without injury to the public whatever. Is there any reason why the party owning the stock should not take an income from it, any more than the party who sat down on a piece of real estate and got his advantage in the value of his real estate from the efforts and energy of the party who put the improvements on the neighboring property? We are not thieves. But we have a difficult game to engage in. We got up into a difficult situation in the case that I referred to a while ago where

a would-be expert professional witness was on the stand. He was paid $50 a day for his expert testimony. I want this to go into the record of this association because I want the association to know that the only foundation the expert witness had as a basis for his temerity in testifying in the fixing of the rate on some innocent individual's property, was the fact that he claimed to have built the original plant in a small town in a city of California. As a matter of fact we absolutely proved by the testimony that Mr. L. P. Lowe was the man who designed the plant and his brother put the plant in operation. We also brought the secretary of the company on the stand and he testified that this would-be engineer had never turned so much as a scratch of the pen for the company. Those are the conditions that have to be guarded against. It is a very easy thing for one who has facility with his tongue to get on the stand and make testimony. It is difficult to get on the stand and prove his testimony an absolute falsehood. It is easy to tell a lie, but it is hard to prove that the man is a liar. I want to warn you gentlemen against it. There are other conditions which we have to face on the Pacific Coast, especially in view of the present legislative condition, and, furthermore, where the small towns with rapid growth are coming through the way they are. As soon as they have a little authority, the officers of these communities are like the Irishman who was appointed to the police force. In the morning he got his star and his uniform and immediately proceeded home. At 2 o'clock in the afternoon his wife swore out a warrant on him for assault and battery. He came up before the police magistrate who said, "Shannahan, how in the name of common sense is it that you were appointed at 10 o'clock and at 2 you are charged with assault and battery on your wife?" He says, "That is easy of explanation. My authority had to be shown somewhere." As soon as these people get the club of authority in their hands they are after you. I want to caution you from actual experience. We have got to conduct our affairs toward the public, not only in the matter of fixing our rates, but in the general conduct of our business, to that point where we can justify exactly what we do. We want to keep our properties in such shape that they are not a dilapidated, run-down, rattletrap proposition. There are lots of them on the Pacific Coast that are still in that condition. We have to realize that there is an investment to conserve and it is up to us to deliver the goods, and we should see that that investment is perfected in every reasonable possible way so as not only to preserve it in its entirety, but to be able to continuously make our return. Just exactly what the final outcome is going to be, I do not believe any of us have gray matter enough at the present time to draw a safe conclusion. We have not come to a safe conclusion on what we mean by depreciation of what reserve should be set aside per annum for replenishment. At the same time we do know this: That there is continuously a certain amount of what we are pleased to term depreciation accruing through the fact of inadequate conditions or inadequacy of plant, together with evolutionary conditions of market changes and invention. Within the last twelve years, you may say, the oil gas business has been going through an evolutionary stage. Every man was operating a plant and operating a type of his own. His apparatus may have been economical or not. And with the conditions that existed all a competitor had to do was to stake his claim and announce that he was going to do business and that was all he had to do. It is a little different now with the state railroad commission. We don't know what they will do. If they take the socialistic view and think competition is a good thing, you may get competition right straight along the line.

President Vance—After the very interesting remarks of Mr. Barrett, I am going to call on Mr. Frank Leach of Oakland.

Mr. Leach—Last year after Professor Cory's very excellent paper had been read a motion was made from the floor that the paper be furnished to all of us for our guidance in the immediate future. It seems to me that such action should be taken in regard to this paper, together with the article on depreciation which Dr. Humphreys has sent as an appendix to his paper, and I would make such a motion.

(The motion was seconded and carried.)

President Vance—Gentlemen, in closing the discussion on this paper, Professor Cory has indicated to me that he would like to say a few more words.

Prof. Cory—I have appreciated the discussion this afternoon. The difference in the methods of manufacture and distribution of gas on the Pacific Coast as you men know it and as Mr. Jones has indicated, and the methods of manufacture and distribution in the East and on the Continent should be taken into consideration in the discussion of the matter of overloading of gas manufacturing plants and the distributing systems connected therewith.

On the Pacific Coast in many cities such as Los Angeles the amount af gas sold has increased from 100 to 200 per cent within a five-year period from a single gas manufacturing plant. In such cases construction and operation are continuously going on at the same time, and it is not a question of what is the ultimate capacity of one gas generating set, but the ability to keep up with the increase in the amount of gas demanded by the community, and the increase has been so great in a short period of time that we have by force of necessity found new maximum ratings for our oil gas generating sets.

I value most highly the discussion by Mr. Barrett of the financial problems confronting the public utility corporations. Unless I am much mistaken, the matter of rates is not of as much importance today to the public utilities on the Pacific Coast as the inability of such public utilities to obtain the money to enlarge their plants and extend their systems to keep up with the growth of the community which they serve. I quite agree with Mr. Barrett also that the average of a given set of conditions can by no means be used as a guide to lead us in prophesying for the future. If averages are to be depended upon for instance it would not be as hot in San Jose today, because the maximum temperature today, unless I am much mistaken, is about twice the mean annual temperature claimed for San Jose by its Chamber of Commerce.

STANDARD OF QUALITY AND PRESSURE OF OIL GAS.

BY H. PAPST.

(Pacific Coast conditions are considered, but the author deals with fundamentals. Proper standards of quality and pressure are essential that the best service be secured. Consideration of maximum by-product should influence quality and would result in greater value of the gas to the consumer and to the company. Legislation based on exact knowledge rather than precedent is urged in this connection. The paper was read at the Pacific Coast Gas Association convention, 1913.—The Editor.)

With the advent of public service commissions the question of establishing proper standards of quality and pressure has received an impetus, due to the fact that rates are inseparably connected with standards of quality. All such considerations ultimately resolve themselves into conserving for the benefit of the public the natural resources of the country and extracting from them the greatest value in the most efficient manner. This view has been adopted by commissions, and being well established, may be used as a basis upon which to elaborate.

It is obvious that one standard, equitable for all sections of the country, is out of the question, since each community is differently situated as to the kind and quality of raw materials available. For this reason, the most suitable raw material, treated in the most efficient manner, from a conservation standpoint, will indicate the proper quality of supply in each locality.

Based upon the above premises, this paper will treat of Pacific Coast conditions, with special reference to oil gas.

Without going too much into the history of oil gas manufacture, which has been ably set forth in earlier meetings of this association, it still becomes necessary to consider the surviving methods of production, as exemplified in a few of our large cities.

The early history of oil gas manufacture has its seat in Southern California, co-incident with the development of the oil fields. The prevailing practice is to distribute a medium grade gas of slightly above 600 B.t.u., with the production of moderate quantities of lampblack and rather large quantities of pitch and tar. To Southern California belongs the distinction of first working up the lampblack into commercial fuel, representing a by-product of such value as to seriously influence the determination of quality.

In the northern part of the State of California the practice differs by the production of a richer oil gas and the admixture of the same with blue water gas made from the briquetted by-product, lampblack, giving a final product stated to be of 650 B.t.u.

Oil gas manufacture in the Northwest has been somewhat similar to the Southern California practice, except that the production in these plants is along the lines of large yields of gas and lampblack, with a minimum production of pitch and tar.

A comparison of these divers methods, along such radically different lines, shows the necessity for a thorough investigation to determine which best represents efficiency in production and conservation of natural resources.

It is evident that the final value to the consumer from a gallon of oil must be the deciding feature, which should be expressed in some definite standard, and I believe that at the present time the consensus of opinion is that such a standard should be expressed in terms of heating value only.

Standard of Quality.

The commercial efficiency of the manufactured product seems to be dominated entirely by the question of by-products. In the manufacture of oil gas the briquetted carbon has proved to be the most wonderful of all solid fuels—a worthy companion of gas in its purity and efficiency. The profits to be derived from the sale of this commodity enormously increases the field of operations of a gas company, attracting new consumers without losing the old ones. It has practically met a long felt want, namely, wholesale heating, for the day is not yet present when gas can compete with other fuels for this purpose. By keeping out the coal man we can keep in the gas meter.

A feature in this connection is the reduction in overhead expense by increasing the volume of business transacted. The more one considers, the more fallacious appears the utilization of salable by-products for the production of gas, when the latter can be produced by the purchase of additional raw materials, without the loss of any profit from residuals. The writer of this paper wishes to go strongly on record as favoring the production of as much lampblack as possible, even at the expense of the gas yield, with the complete elimination of tar and pitch.

It would seem that the greatest economy in operation is reached with the cessation of the production of tar and pitch, at a point ranging between 535 and 550 B.t.u. The consequent reduction in holder costs, due to the additional briquet sales, enables the selling price of gas to be correspondingly reduced, thus working a direct benefit to the consumer. It is obvious in this connection that one opens up, also, new fields for the use of gas along industrial lines, which must result in a further increase in volume.

Besides the increase in volume and the reduction in selling price, we place in the hands of our solicitors a formidable weapon against a straight crude oil heating system, principally on the score of safety and simplicity.

The development of the gas business along the lines of these ideas has hitherto been handicapped by legislation, but a definite stand by the Pacific Coast gas fraternity should be productive of results with the commissions or local authorities.

The distribution of gas, from the standpoint of quality, is all in favor of a gas containing no hydrocarbons in vaporous form; in other words, a gas in which all the vapors have been converted into either lampblack or gas. It is obvious that a low grade gas will not suffer in transmission by high pressure (and high pressure distribution is much practiced on this coast), and it has been likewise found that the problem of pipe jointing, as met with in rubber Dresser gaskets, has been much simplified by the elimination of the hydro-carbon condensate. On the other hand, the gas meters, which are, after all, the index of our earnings, have been found to attain an extraordinary degree of accuracy, extending over a much longer period when the diaphragms are no longer subject to the dissolving effect of liquid hydro-carbons. On account of the lower specific gravity of the gas, there also results an in-

creased efficiency in transmission and distribution by the greater capacity of the system, with a corresponding reduction in the investment charges.

Having discussed efficiency from the standpoint of production and distribution, it now becomes incumbent to consider the same from the standpoint of utilization. The requirements of the consumer must be examined, in order to ascertain if his needs can be adequately served by the quality found to be the most efficient from the production and distribution standpoint. Modern investigation, represented by the experiments of Dr. Bunte and others, shows that the efficiency of combustion has but little relation to the calorific value, but that the various uses of gas are far more dependent upon other factors, such as flame temperature, flame volume, and the specific heat of the nitrogen and other products of combustion, as will be further dealt with under the requirements for pressure standards.

On the other hand, gases of high calorific value, meaning high percentage of hydro-carbons, are difficult to burn completely, and this imperfect combustion tends to the production of odors, and in some instances to the production of dangerous carbon monoxide, likewise to the blackening of ceilings and fixtures, which is detrimental to general cleanliness, the strongest asset of gas for fuel.

The writer's personal experience in Portland, where candle powers from 15 to 19 have been distributed at various periods in connection with the reduction of sulphur compounds, previous to the introduction of the reheating process, has fully demonstrated that the public greatly preferred gas of a lower quality, from a convenience standpoint, as shown by the large number of complaints resulting in connection with high candle power, and the cessation of the same with the re-establishment of a lower standard.

The considerations presented above in connection with the proper standards of quality might seem to be dictated by the personal experience of the writer. It is therefore pertinent to mention briefly what seems to be the trend in the East and abroad. The recent investigations by the committee on calorimetry of the public service commission and gas corporations in the second public service district of the State of New York have shown a radical change of ideas in favor of a lower standard from those previously accepted for many years, with strong leanings to still further reductions eventually. Quoting from this report, page 12, article 34, "It is difficult, indeed, in view of the uncertainty as to just how fast certain changes in the conditions governing gas manufacture and distribution will take place and as to what the final situation will be, to determine the proper value at which to set the standard. It has been shown that some time in the future the standard may have to be 525 heat units, or lower."

The standards abroad have crystallized even more definitely in favor of a very low standard. In 1906 the calorific value of 500 net B.t.u. gas was adopted for Tottenham, in England, while previously illuminating value of the London Company were in force equivalent to calorific value fully as low. On the continent, Paris and Rheims have adopted a value of 528 net B.t.u., and Milan, Italy, 573 B.t.u. In Germany, during 1909, it was concluded that there should be a calorific test and that the same should be set at 543 gross B. t. u. It should be noted in this connection that it is customary on the continent to correct the gas volume to 32 F., instead of 60, which means that the standard is comparatively 5 per cent lower than these figures; e.g., 543 gross would become 516 gross. In South America, Colombo has had a heating standard of 400 B.t.u. for the last five years and in Buenos Ayres it is required that the net B.t.u. shall not be less than 539.

From the above it will be seen that nothing radically new has been advocated by the writer in connection with the standard of quality. The recommendations are made solely on an efficiency basis and from the standpoint of the economical development of the industry.

Entirely too much legislation has been enacted solely on the strength of precedent; indeed, the gas industry has been too much hampered by its traditions. Is it not time to cut loose from meaningless standards, allowing the industry to expand along logical lines of development, represented by lower prices, and, since most companies are all organization and no output, by increased volume and larger net earnings?

Standard for Pressure.

Before entering into the question of proper standards for pressure, it is pertinent to inquire what function is fulfilled by the pressure requirements in the distribution of gas. These may be divided into, first, the requirements for the transmission of the gas through the mains, and second, the needs of the consumers' appliances. When gas is transmitted by what is commonly known as high pressure, the distribution problem does not enter, while the distribution of gas by low pressure, as measured in inches of water, bears a fixed relation to the area of the territory to be covered and the capacity of the system of mains with respect to the volume to be furnished.

It is at once evident that we are confronted again with the requirements of the locality. Considering that most of the localities have been established for many years and that the distribution systems have grown up with the community, conditions may readily prevent a realization of the ideal system from a theoretical standpoint. The public service commission may, however, and should, insist on such expenditures as are possible and advisable to correct any glaring defects. Assuming that this has been done, it is obvious that the initial pressure to be carried must be such as to give service to the most remote consumer. A differential pressure is commonly assumed of one-half inch per mile of main, and this would seem to be a fair allowance to supply the neecssary volume. This amount, should, therefore, be added to the necessary pressure required by the consumer.

One must also consider the fluctuations of pressures, which are the principal cause of complaints by the consumer. It is apparent that with the higher initial pressure the percentage of fluctuation will be less at the outskirts of the system and regulation correspondingly easier. To illustrate: If the extreme points of the system are three miles from the nearest holder, it will mean a variation of pressure of at least 1½ in. at the initial point, so that if the maximum

allowable pressure were three inches, the suburbs would have only 1½ in., or a variation of 50 per cent. But if the maximum pressure allowed were eight inches, with the same loss in transmission, it could be arranged so that there would be no variation in the suburbs, while the variation at the initial point would not exceed 20 per cent.

In addition to the foregoing, there remains the question of altitude—a factor beyond the control of the utility. An allowance for the same has always been considered in previous regulations by the commission.

Pressure requirements have always been somewhat dependent upon the specific gravity of the gas, which, again, depends upon the quality of the gas manufactured. It follows, therefore, that to provide the same results, the street pressure must be varied inversely as the specific gravity.

Now, considering pressure from the standpoint of utilization, it is at once seen that the proper pressure is dependent upon the quality of the gas, that is to say, insofar as quality influences the specific gravity. Inasmuch as nearly all appliances burning gas use a syphon effect for mixing the gas with proper portions of atmospheric air, and since the amount of air entrained into the mixture is proportional to the mass of the gas, and since the mass is proportional to the specific gravity, it follows again that with different specific gravities, to produce the same result will require a different street pressure.

It has been found that a very much greater efficiency in the utilization of gas may be brought about by approaching as nearly as possible to the theoretical limit of primary air admitted for complete combustion. Inasmuch as the limiting feature in air mixers is the propagation backward of the explosion wave, which must be overcome by the velocity through the mixer of the air and gas, it is essential that the pressure furnished must be ample to insure this result. It follows, likewise, that the higher the pressure available, the nearer the mixture may be brought to the theoretical limit, which means, in turn, greater efficiency in utilization.

These facts have been very strikingly illustrated by the increased efficiency of incandescent lighting by means of the higher pressures, such as, for instance, the wonderful street lighting systems now developed in European cities. The same applies likewise in a lesser degree to ordinary incandescent lighting by low pressure. To illustrate these remarks I had our laboratory make some experiments, which show how remarkably the consumer benefits by increased pressures.

Increased Efficiency of Incandescent Burners With Increasing Gas Pressure for the Same Consumption of Gas

Test made with an upright Welsbach mantle.
Gas Rate 3.2 cu. ft. per hour.

Pressure in.	Candle Power.	Candles per cu. ft.
3	39.1	12.2
4	41.9	13.1
5	44.7	14.0
6	47.5	14.8
7	50.3	15.6

As a corrollary, the lighting capacity of the various units is much increased, enabling competition with electric units to be more easily met by the standard burners. To illustrate: A 4-burner gas arc can be replaced advantageously by a 3-burner arc, providing the street pressure is available to operate the same at high efficiency. It follows, also, that the danger from flashbacks in the mixer is much reduced when the higher pressures are available.

The consumer benefits, in addition, by a saving in time, effected by the increased rate of combustion, which incidentally reduces the radiation losses.

The requirements of the industrial appliances, without going into detail, necessitate, in the same manner the greatest available pressure at the nozzle. In many cases a lack of the same makes it necessary to install booster, or air blowers, at an additional expense.

From the above it would appear fallacious and to the direct detriment of the consumer to require an upper limit on the pressures carried in the distribution system. No gas company will increase the pressure in its mains beyond a point of economical demand, influenced by a fear of leakage, although it does not appear in any sense that the higher pressures are anything but a blessing to the consumer.

Summary.

With regard to the standards to be adopted on the Pacific Coast for oil gas, and with due regard to the development of our business, these should be based upon the most efficient methods of production with respect to the conservation of our natural resources, and it appears, furthermore, that oil gas conditions would require the production and distribution of a gas of lower calorific values than those at present prevailing, especially in the California cities, and that the same is in accord with the trend of gas practice in the Eastern states and abroad. Conditions for pressure would require that no upper limit be placed for efficient utilization of our product.

Conclusion.

Inasmuch as no standards have as yet been established for oil gas on the Pacific Coast, it behooves us in this convention assembled, representing all sections of the Pacific Coast, to determine in advance of any decision the proper standard which we should urge upon the commissions, lest ill advised legislation, which is always difficult of repeal, should retard our further progress.

While the writer's ideas are set forth, he hopes that a full and free discussion will result, leaving it to the appointment of a committee to give the matter a full and thorough investigation.

Canada's waterpower is estimated at 16,600,000 h.p., of which only about 1,016,000 h. p. has been developed.

The manufacture of ice calls for a consumption of 46.89 kw.-hr. per ton according to data compiled from three large plants.

Electricity in Rural Districts, a report made by the commercial section of the National Electric Light Association to the Chicago convention last June, contains much valuable data on power required, costs, etc., of farm machinery.

WRINKLES.[1]

BY H. W. BURKHART.

1. **Appliance Stand.**—(Fig. 1) This consists of a very simple, cheap and durable stand for mounting appliances in the display room and also serves as a truck to easily move appliances around. It can be adjusted to meet all conditions. The stand consists of maple disks, 4 in. in diameter by 2 in. thick; counter sunk 3 in. x ⅝ in. At right angles to these disks holes are bored one inch deep. Into these holes ordinary black pipe

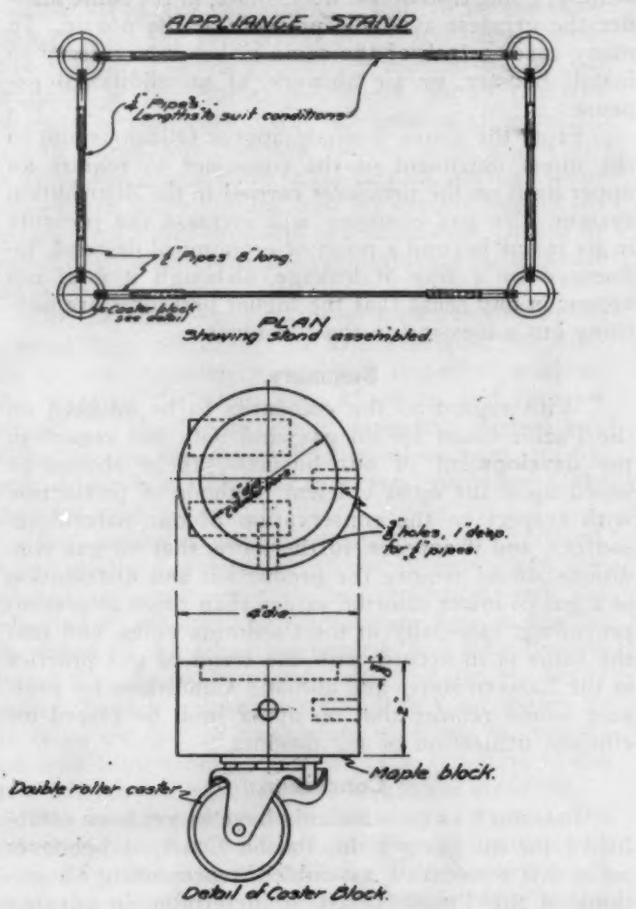


Fig. 1.

is inserted and the whole assembled as in sketch. On the bottom side of the disks double roller casters are mounted.

Frank Wilson.

2. **Measuring Tank for Oiling Gas Meters.**—(Fig. 2) This consists of a tank made of No. 20 gauge galvanized iron, 18 in. high and 9 in. dia. Inserted in one side is a gauge glass made of heavy plate glass 10 in. x 2 in. This is set in a frame with a scale marked on one side for measuring the amount of oil to be used for each meter. The divisions in the scale are 7/16 in. apart, which equals one pint of oil. The tank is to be filled with oil to the top of the glass, which would be about 3 gallons. The remainder of the tank is for air pressure which is supplied by an ordinary automobile air pump through an ordinary air hose such as is used in a garage or bicycle shop. On top of the tank is a 5 light meter screw taken from the side pipes of a meter with a tubing cock screwed in for attaching the air hose. At the bottom of the tank there is a ¼ in. lever cock with a short piece of air hose attached. The end of the hose has a piece of copper tubing about 3 in. long; the end of this copper tubing is inserted in the holes punched on either side of the side pipes on the outer side of the meter. By turning on the lever cock the required amount of oil can be forced in the meter without any waste whatever.

By the use of this device a 5 Light Meter can be oiled in about 25 seconds, where by pouring the oil in it takes over a minute. We find this device to be one of the most economical and essential things used in the meter shop. However, if we were to make another we would use a regular water gauge glass in place of the plate glass.

W. H. Partridge.

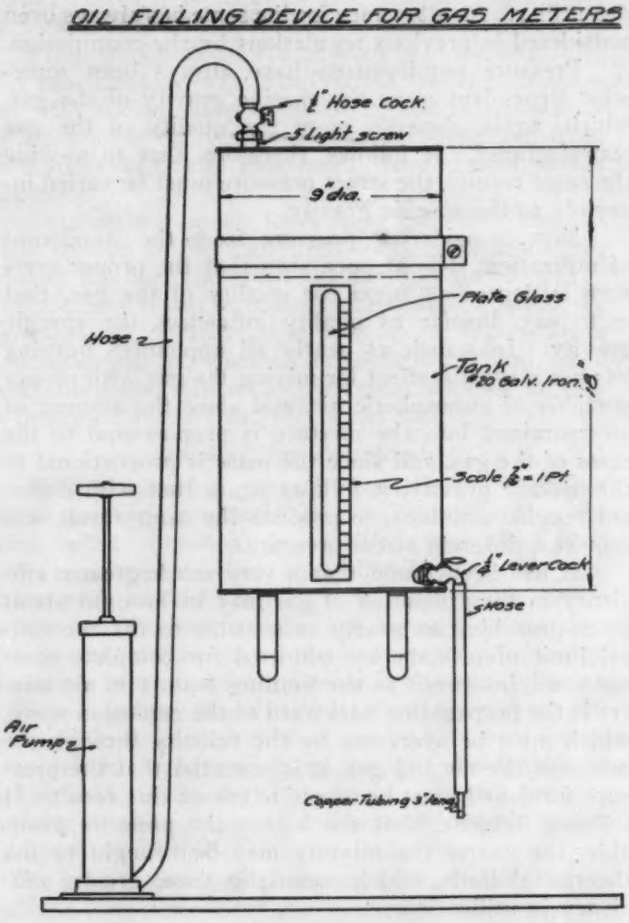


Fig. 2.

3. **Superheated Steam for Oil Gas Generators.**—In most oil gas plants, steam is used for injecting oil into the gas generator, the amount of steam depending upon the amount of oil being used. It was thought that if this steam could be superheated, without additional cost, a saving would be made. To this end a coil of pipe was arranged inside the gas off-take pipe, or generator stand-pipe, as close to the generator as possible. After passing steam through this coil we were enabled to get a 50 degree superheat from the heat of the generated gas passing through stand-pipe on its way to wash-box.

The result was a material saving in fuel oil used for heating.

J. F. Creighton.

4. **"Benso" or Distillate, Obtained From High Pressure Gas Mains for Use in Auto Trucks.**—In the drippage, from our high pressure mains, we obtain an oil which, when distilled, is used for fuel in our auto trucks. The still used for distillation is made from a 24-in. tee around which is built a furnace. It has a capacity of 200 gallons per day, and 4c per gallon would easily cover the cost of operation. The fuel used for this still is muck from the wash-boxes of our oil gas generators.

[1]These wrinkles, contributed by members, were submitted by Mr. Burkhart at the twenty-first annual convention of the Pacific Coast Gas Association, 1913.

The product, after distillation, is termed "Benso," and has a gravity of 45 degrees Be' and a flashing point at room temperature. We are using this "Benso" very successfully in our automobile trucks by the use of a gravity raising device, before the carburetter, which is obtained from automobile supply dealers.

J. F. Creighton.

5. **Hot Air as Conveyor for Fuel Oil Under Furnaces Where Steam is Not Made.**—The excessive expense of the use of compressed air, at atmospheric temperature, for injecting oil for fuel purposes is well known. It was thought possible to obviate this by heating the air after compression. This was done by setting a coil, (approximately 100 ft.) of one in. pipe, cut in six ft. lengths, in part of furnace that would keep temperature of air at approximately 450 degrees, Fahrenheit.

The results obtained were very gratifying.

J. F. Creighton.

6. **Collapsable Leak Tube.**—(Fig. 3) We have several inspectors whose duty it is to follow up reports of leaks in streets, who have been carrying short lengths of half-inch pipe to insert into the sewer inlets, manholes, openings in streets, etc., for the purpose of locating leaks. The pipe was rather cumbersome, therefore we use the collapsable tube which folds up and is easily carried in the pocket, being a very compact and handy instrument for the work.

D. E. Keppelmann.

7. **Testing Cap on High Pressure Work.**—(Fig 4) For testing high pressure mains it has been necessary to use the great-

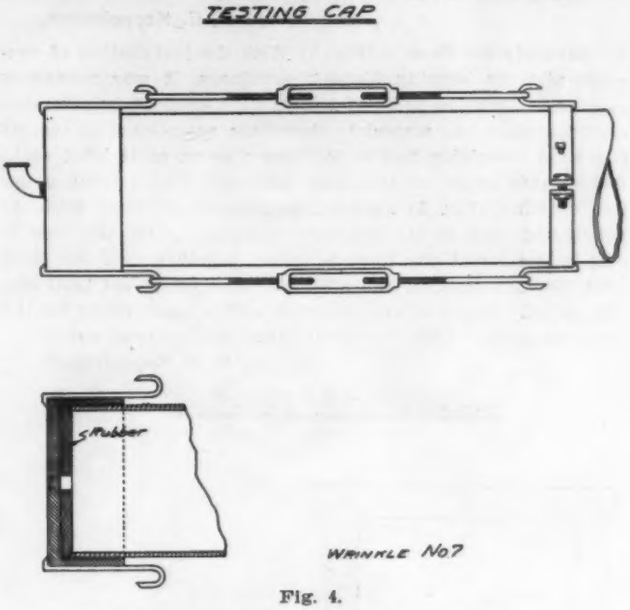


Fig. 4.

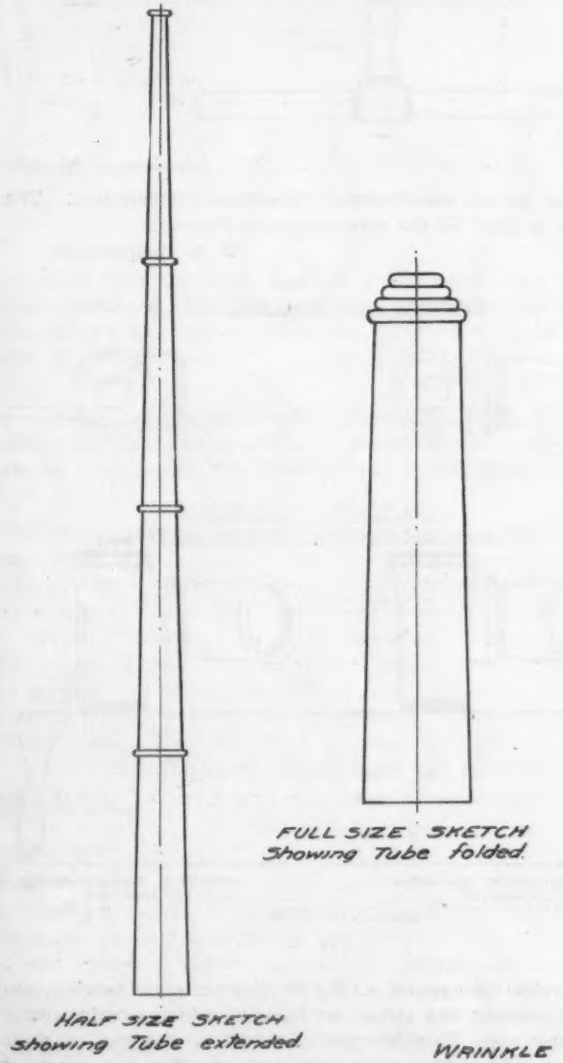


Fig. 3.

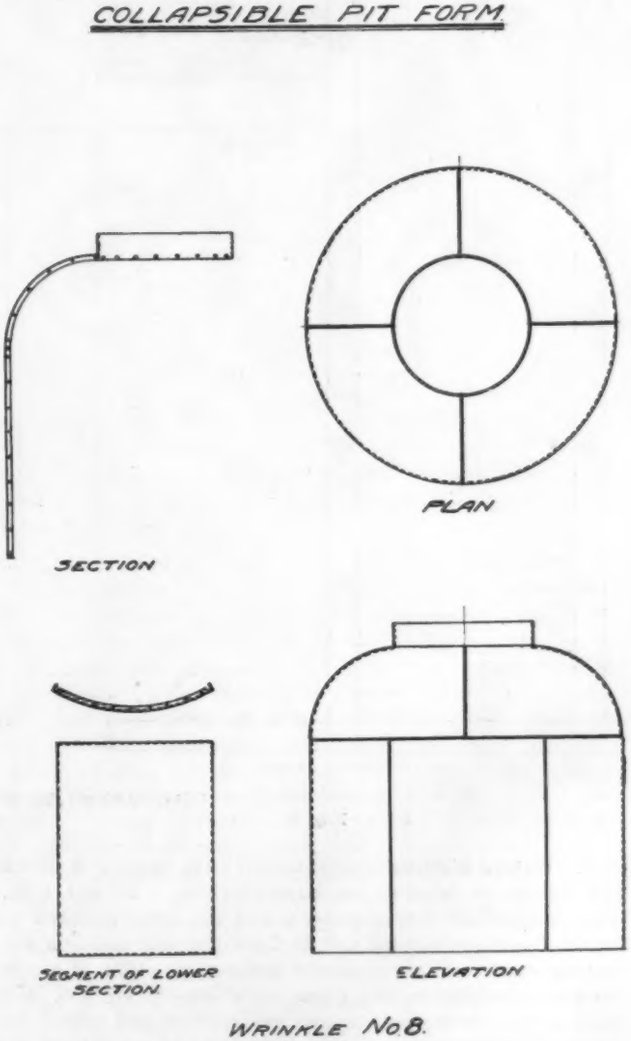


Fig. 5.

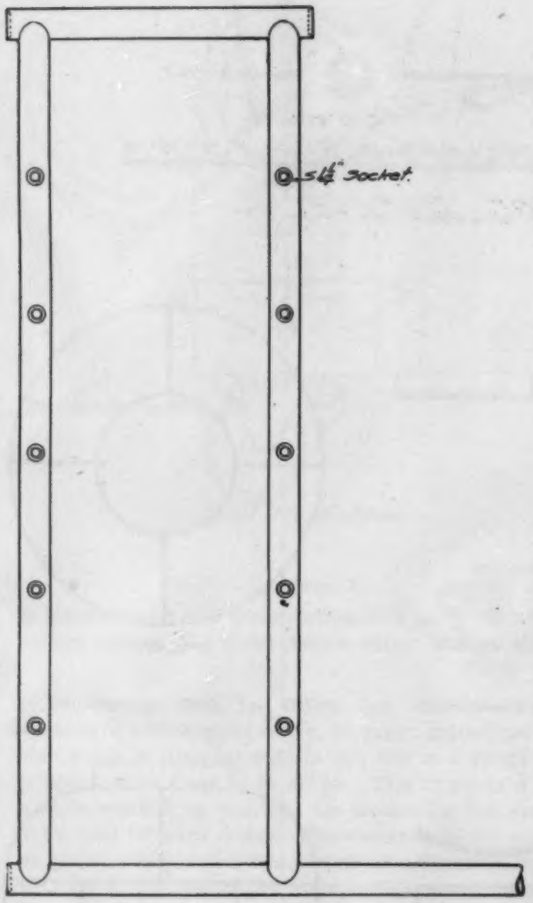
est care in bolting on a blank flange or head together with the necessary barricading which was a long and tedious job and not always certain as to its absolute security. Instead, a testing cap is placed over the end of the main and bolted to a lag screw to the main being tested. It is always ready, easily adjusted and is absolutely secure.

D. E. Keppelmann.

8. **Concrete Pit Form.**—(Fig. 5) With the installation of concrete pits for housing district governors, it was necessary in each installation to build a form with wood at considerable cost for labor and material. After the completion of the pit the wood invariably had to be thrown away, or at least could not be used again for the same purpose. The accompanying line drawing (Fig. 5) shows a collapsible pit form made of corrugated iron in six different sections. After the hole is dug in the street the form is bolted together in a few minutes, set into position and after the concrete is set each section quickly unbolted and removed, and is again ready for the next operation. This is a great labor and material saver.

D. E. Keppelmann.

WELDED DISTRIBUTOR

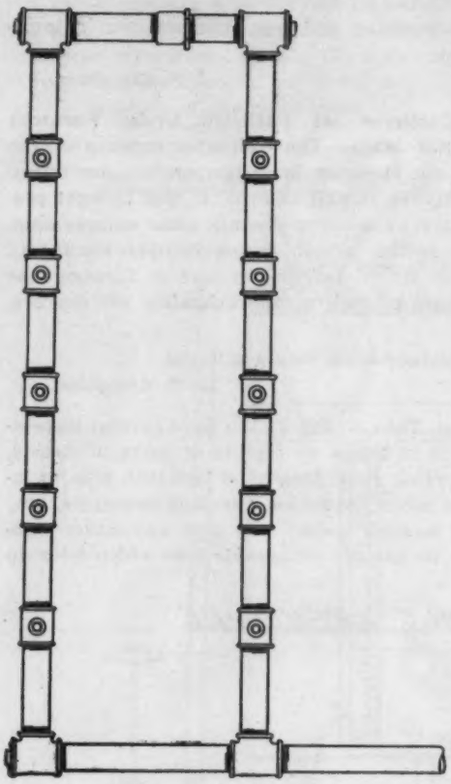


WRINKLE No. 9.

Fig. 6.

9. 9a. **Welded Distributors.**—(Fig 6) The distributor is shown with outlets to meters. On large services, 3 in. and 4 in., these fittings are very expensive and the labor required to cut the necessary nipples and fit these together makes a distributor an exceedingly expensive installation. (Fig. 7) shows the same distributor, the pipes being welded together and holes burnt into the pipe and socket inserted and welded for outlets to meters. The saving on fittings and labor is 50 per

DISTRIBUTOR WITH FITTINGS

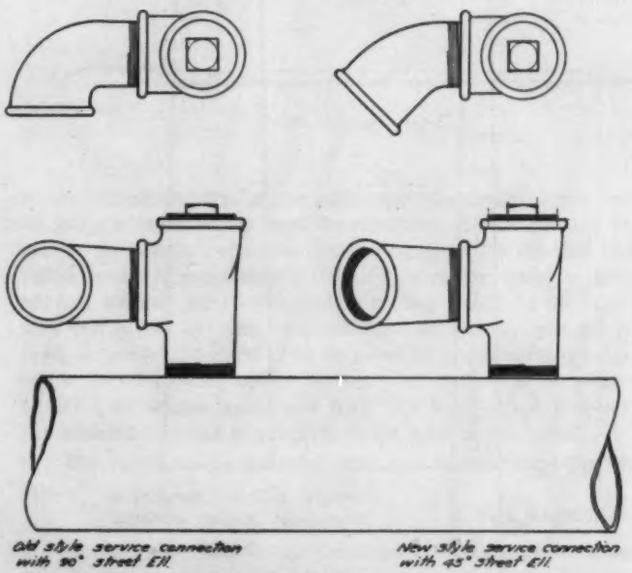


WRINKLE No. 9A.

cent and makes an absolutely permanent installation. The welding is done by the Oxy-Acetylene Process.

D. E. Keppelmann.

SERVICE CONNECTION



WRINKLE No. 10.

Fig. 8.

10. **Service Connection.**—(Fig 8) The old style service connection consists of a street tee inserted into the main with a 90° street ell. This brought the flow of the gas at right angles, causing some stoppages at times. The 90° street ell

has been eliminated and in its stead we now use a 45° ell, making the flow more direct.

D. E. Keppelmann.

11. **Emergency Gas Stopper for Mains.**—(Fig. 9) Sometimes it becomes necessary to replace a 3 in. or 4 in. main with a larger size. A hat flange is found providing outlet only for the smaller size main, necessitating the replacing by a larger hat flange providing outlet for the larger main. In order to prevent the flow of gas without necessitating bagging off the main, a piece of heavy rubber of sufficient size to cover the opening is rolled and inserted through the opening with a string attached. The pressure of gas unfolds the roll of rubber and blowing it against the opening in the inside and is

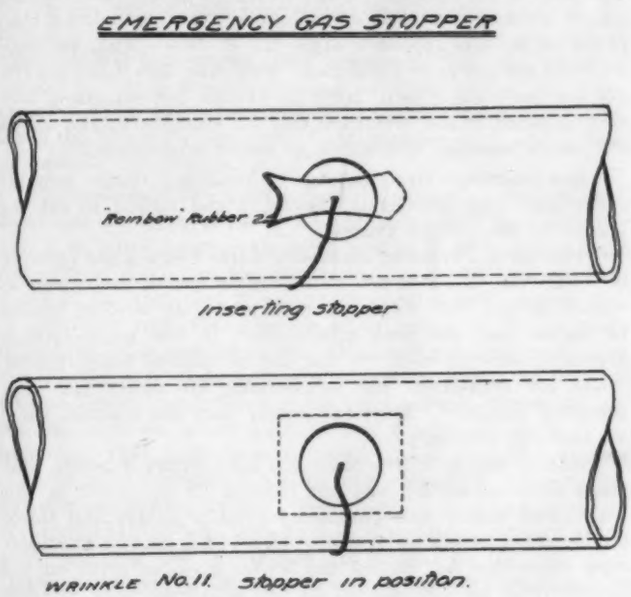


Fig. 9.

held there until the larger opening is made and the new hat flange bolted on. This has been used very successfully, has eliminated a great many difficulties which occur in an operation of this kind.

D. E. Keppelmann.

12. **Rubber Stopper for Service Connections.**—(Fig. 10) Frequently we receive an order for the installation o. a service on existing 2 in. mains, this necessitating cutting the main and inserting a tee in the line. To prevent the loss of gas and annoyance to customers, as well as to overcome any possible damage to the fitter, the cut in the main is made and a 2 in. rubber stopper with a string attached placed in each end of the cut main, stopping the flow of gas. The main is threaded, tee inserted and the stopper withdrawn by pulling the strings through the outlet of the tee.

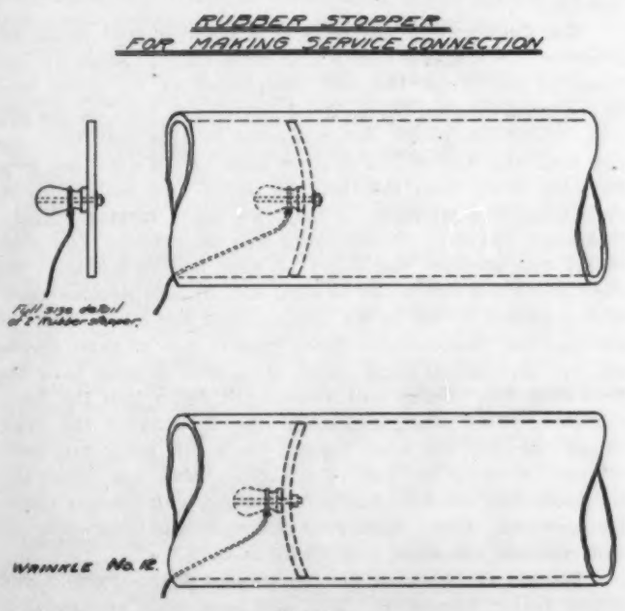


Fig. 10.

D. E. Keppelmann.

13. **Shutting a Valve Under Hot Water.**—In order to put a foot valve on the suction of our circulating water pump it was necessary to shut off the water from the settling pits to the well. The valve used for this is a common irrigating

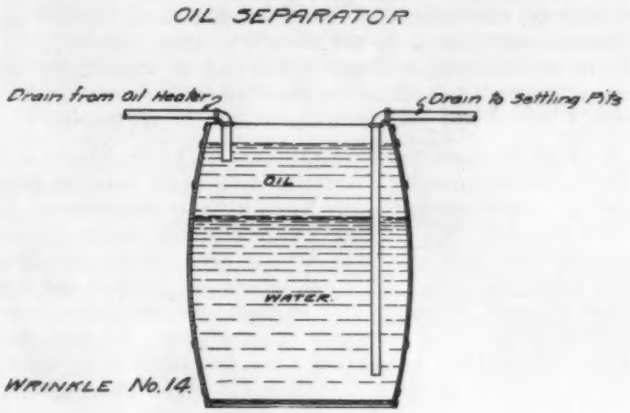


Fig. 11.

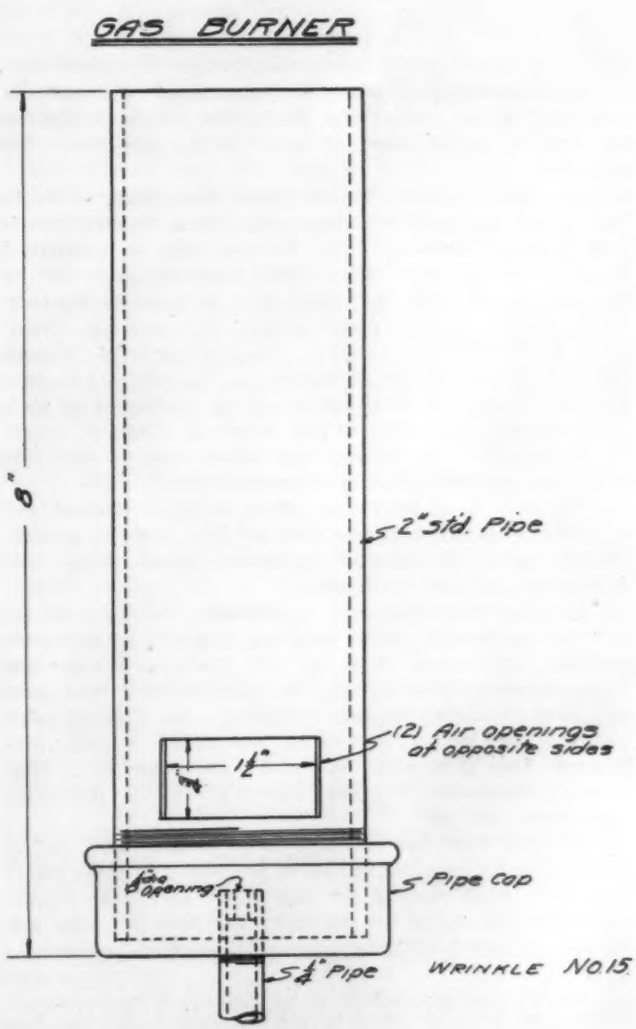


Fig. 12.

gate, the top of which is about twenty inches under water in the last pit. In some way the gate had been pulled out of the guide slots and we could not get it back in place without using our hands to guide it. As the water was too hot to work in we were up against it until the thought occurred that if we put a piece of pipe down in the water directly over the valve and turn cold water down it a man's arm could be inserted through this pipe. The force of cold water running down the pipe kept the hot water away from the man's hand which was below the pipe. We used a piece of 6 in. stove pipe and a ¾ in. hose.

D. W. Connell.

14. **Oil Separator.**—(Fig. 11) Our oil heater began to leak and enough oil ran through the drain, which runs to the settling pits, to make a mess on the water. To avoid this we put a barrel on the ground as per sketch and by dipping the oil out of the barrel about once a week we had no more trouble.

D. W. Connell.

15. **High Pressure Gas Burner.**—(Fig. 12) While running a 7 in. suction line from the circulating water pump and after having two pieces screwed up we found it would be necessary to bend the pipe. We therefore constructed the burner as per sketch. The bend was made directly over a 10 in. gas pipe. We raised the 7 in. pipe a few inches and covered the gas pipe with dirt, placing a brick on top of the dirt and a piece of iron on the brick to keep from crushing it. We then laid some old fire brick around the 7 in. pipe, about 12 in. apart, to form a sort of furnace to hold the heat. Five minutes after the gas was lighted we had the pipe bent.

D. W. Connell.

EXPERIENCES.[1]

BY JOHN CLEMENTS.

At that delightful, ever to be remembered, twentieth session held in the city of San Diego, the President honored me with the appointment of editor of the Experience Department.

The duties imposed by this appointment seem to me to have grown more and more important, as the present twenty-first session draws near. I fear, however, that its importance is not shared by many of my fellow members, or it may be that they do not fully understand what is meant by the term "Experience." I have asked myself this question several times in the past few months. The term or word "Experience" is defined by the authorities, as that which has been learned, suffered or done considered as productive of practical judgment and skill; the sum of practical wisdom taught by all the events, vicissitudes and observations of one's life, or by any particular class or division of them.

To quote from Emerson: "In a world so charged and sparkling with power, a man does not live long and actively without costly additions of experience, which though not spoken are recorded in his mind."

On June 9th of this year, our secretary sent out my appeal to you for help, asking you to send me in some of your personal experiences, along the lines in which we are mutually engaged. In the appeal, I enumerated the various lines as follows: Manufacture and Distribution; Gas Lighting; Gas Heating; Gas Cooking; Sale of Gas Appliances; Rentals; Collections; Your Experience With Gas Versus Electricity; Consumers' Complaints; Personal Experiences With Individual Consumers, etc., etc.

The past year has indeed been an eventful one, full of experiences for many if not all of us. Many of them would have been good reading for this paper but owing to the proverbial modesty of the gas man, they have not been considered of sufficient importance. So on these grounds, I excuse you this time, but insist that you do better for my successor.

Gas Lighting.—Under this head, we find that gas lighting is still advancing, the gas arc holding first place where a great and concentrated amount of light is required, for large stores, factories, and outside illumination where volume of light and economy are considered.

It is not the purpose of the editor to point out any special type of arc lamp or of any special make of gas appliance, but here is a very good story that comes awfully near doing it. This story was given out by the Gas Arc Department of one of the large cities and has been published in a special magazine, but as the circumstances connected therewith has to do with one of the members of this association, I have deemed it worthy of repetition: An old colored man called at the gas appliance store in ————, Cal., to place an order for one or two gas arcs. This man, like many others, did not know the type of lamp he wanted, but remarked that he had heard of the Welsbach and the Humpback, and asked our fellow member which one he would recommend.

Gas Heating.—Gas heating is becoming more popular every day, thus increasing the make and output in all the plants on the Pacific Coast.

The various types of automatic water heaters are growing in favor—the fact that hot water can be had at the faucet as readily as the cold water, induces people in modern houses to install and use such appliances. In the more humble homes of working men, we find the circulating boiler heater. These are convenient and economical; are easily and inexpensively installed. Most any handy man can connect them up and get results.

One of our members reports a case where a handy man made such connection and got results. It happened in this wise: This handy man purchased a water heater and thinking he would save a little money, he told the man at the appliance store that he wanted the lowest possible price on the heater; that he intended to do the plumbing work himself. The result of this was, that this man connected the fuel run to the water connection and the further result was that something more than ordinary condensation got into the fuel run, the meter, and in the main outside, with the further result that he not only put his own appliances out of commission but that a great many others were without gas and the company received a great many complaints at the same time, with a big job on their hands to find a low place in the mains and let out the water. Besides all this, many persons not knowing the real cause, complained of rotten service.

Gas Cooking.—In gas cooking a member sent in an experience: We sold a lady a first class range. After we had installed the range, the lady complained of too great heat in the oven, causing cakes, bread and pies to burn on the bottom. Over the phone, we suggested to this lady that she cut down the flow of gas to oven burners. We did not hear anything more from this lady for some time and supposed everything was all right. Finally we heard from her again. This time, however, the complaint was the reverse. Her complaint was that she could get no heat on the bottom. We then asked this lady to let us send out our lady demonstrator. She answered, "Yes, by all means, send her out." This we did and the demonstrator found two inches of sand spread all over the bottom plate of the oven, thus holding back the heat from the bottom and directing it down into the broiling oven. The demonstrator, of course, removed the sand, raised the rack, did some baking, the result being full satisfaction. Meeting the man of the house sometime afterward, we asked how his wife was getting along with the gas range. He answered, "Fine! Since your Demon-Straightener came out and removed the sand, everything is O. K."

Rentals or Sales on the Installment Plan.—From a furniture dealer, who says: "We have been quite successful in

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[1]These experiences, submitted by members of the Pacific Gas Association, were presented by Mr. Clements at the San Jose convention, 1913.

the sale of gas ranges on the installment plan. We find that the gas company is not very liberal in extending credit to would-be purchasers. At least that is what the would-be purchasers tell us. We sell any of our goods on the installment plan and of course this includes gas ranges. Usually the gas range is sold along with other household goods and collections are made monthly or weekly as the purchaser arranges. We find that the average young woman wants a gas range or else she will compromise on a coal range with a gas attachment and I suppose you gas company people find that even then she is most liberal in the use of the gas attachment. Of course, if we sell her a coal range this means that the hot water for bath and other uses is heated from the coal range, but where we sell a gas range, we usually sell a circulating boiler gas heater, and that means that all fuel used in the house is gas." Asking this party if they made any special effort to sell gas ranges, they answered, "Oh, no, we show people our stove department and let them choose for themselves." You gentlemen managers of gas companies, note what the furniture dealer has said; ponder on it and govern yourselves accordingly.

Collections.—The most important feature of all business. It is one thing to make a sale or to furnish a commodity but it is quite another thing to gather in the shekels. As the sale of gas is of its very nature, a credit business, because of the fact that it cannot be bought, sold or delivered in the lump sum, the question of collection is all the more important. The consumer has completely used up, destroyed, our product several days, weeks or months, before we can call on him for payment. We can not by any legal process obtain possession of the goods we have sold him, therefore, it is all important that collections be promptly made. The experience of this department and of the individual collector are too numerous to mention. The greatest tact and patience are required of those who handle this branch of our work. Many excuses and complaints are offered to the man that rings the door bell of the average consumer. Therefore, I should say that a man must at all times be self-possessed, be able to hold back the wrath that is in him, always polite, do the best he can to gather in the aforesaid shekels, be honest in making his returns and able to retire at night with a clear conscience and an unruffled temper.

I may add here that the collection department is of all departments, the most important. The results of its work are felt all along the line—the man who furnishes raw material, those who manufacture, the manager and the every day clerk and laborer are all dependent on the successful management of the collection department, to say nothing of the men whose capital is invested in the enterprise.

Gas Versus Electricity.—One member says that in the ordinary business of his company he has found many instances where the consumers have given up the use of current for gas because of first cost and further because of the dependable conditions under which gas is supplied. The conditions are familiar to all of you and therefore need no explanation. Gas is always ready, always on tap, while a very slight tap will send electricity a glimmering.

With the pilot light attachment and self lighting air valve attachment, the instant lighting is equal to the electric switch. Another member relates an instance where a fire occurred in a two-story building, the lower part of which was occupied as stores. The stores were badly damaged; electric wires were severed and pulled down; the gas runs attached to the ceiling joists remained intact and several gas arcs hung on their drops. The glass globes of course were broken but the mantles hung in place and and the lamps were burning after the fire had been subdued; another evidence of the reliability of gas.

Accounting.—The following experience is the result of presuming:

In the regular way a closing statement was taken when occupants moved from a certain address. The closing reading showed, we will say, 289, and the meter was locked, which means the gas was turned off at stop cock. This was some time early in the month. When the meter was read at the regular stated time, it was returned as reading 334, thus showing a consumption of 4500 cu. ft. As the company had not been notified by any one, that the place was again occupied, this of course did not look right. Accordingly a man was sent out to investigate, with the result that he found the house occupied by a new party. This man obtained the name of the new occupant and at the same time took statement which showed the reading to be 289, the same as given at time meter was locked. The last statement shown in ledger that was just being closed was 334; was transferred to a new ledger as 334 and this statement coming in as 289, the bookkeeper made the account read 389, thus again charging the party 5500 cu. ft. or a total in the two transactions of 10,000 cu. ft., when as a matter of fact no gas had been used. The party was presented with the bill, but insisted that she had not used any gas. As this sort of statement is very common, it was not readily accepted, but the payment of the account was insisted upon by the collection department. Shortly after the presentation of this bill, at the request of the consumer, the meter was removed and the out statement showed 289, confirming the statement of the consumer that no gas had been used and confounding and confusing the management, collection, and the complaint departments, and all of this because of the presumption on the part of a bookkeeper. In a large concern where over seventy-five thousand accounts are handled every month, errors will, do, and are bound to creep in. This experience is given for the purpose of showing that nothing should be taken for granted. The consumer in this instance was a very reasonable person. The incident was closed quite satisfactorily to all concerned, yet through it all was an under current on both sides that all was not said and done strictly on the square.

Be sure you are right; then go ahead.

Guess work is good work when it hits; but it seldom hits.

This from a Chinaman:

July 9, 1913.

Mr. Gas Company.

Gentelmens:—You send me big bill one month; next month you send me little bill what fo! usem gas alle time same. I think he leak, some time smell velly bad. You scndem you partner down look, so he can smell and fix him soon, take him to your office.

Another:

Pacific Gas & Electric Company.

Dear Sir:—My room has been fire two weeks ago so I will get off from that place. I beseach to your kindly sent your partner to come to take the gas meter off as soon as you possibly please. But the deposit receipt was burned up by the fire Can you count him up so you see how much I ought to receive, so you can send it to me to Gum Lung. Well so long Good Bye.

Yours truly, CHANG YUEN.

This from a son of Nippon:

"Honorable Sir Mr. Gas Company I wish to leave not your meter in the house when I go because I will move to ———— street, so if you come now and count how I am to pay you this month, I will be much pleased to fix the honorable matter up so satisfaction will come to your Company and to

"'Yours very much respect, H. HONCHOH."

Personal Interviews.—From a member of the commercial department:

A young man was given a district where it was specially desired the consumption of gas should be increased.

This particular point was very effectually impressed on the commercial man, increased consumption is what you are working for. "Increased consumption it shall be if I can make it so," he said to himself. One day while talking to a prospective purchaser of a gas range, he happened to say, "I am working hard to increase the consumption of gas in this part of the city." "Oh!" exclaimed the woman, "that is why you are so anxious to sell me a gas range, is it? Well, you can just trot along young man. My bills are big enough already."

Moral: Keep ever in view the main object, but don't always tell the other fellow.

Another commercial man has this to say:

"I have charge of a district in which I am looking for new business, and incidentally giving considerable attention to complaints of consumers. One day during the past year I met a lady who had a sore grievance against the gas company, and it ran something like this: This woman had two meters located under the front steps of a two-story house. This two-story house was supplied through one of these meters. The second meter supplied a small bungalow on the rear end of the same lot. She had requested the removal of one of the meters on account of the two-story house being vacant. Accordingly a regular tag was made and in doing so the company number of meter was not given correctly. The result was the man removed the wrong meter and the woman was without gas to cook her evening meal. She telephoned to the company's office and the man was sent back to restore the meter. Now this woman had worked herself into a passion and by the time the man returned to correct the error, to use her own language, she was "good and hot." Accordingly she pitched into the meter man and over his shoulders, the whole management. The meter man, however, was mute—that is, he said nothing; offered no excuse; simply did his duty in restoring the meter to its proper place and after only a short delay, the woman was again supplied with gas. When I met this woman, it was several weeks after the incident here related. She was still "hot," not so much, she said at the gas being shut off as she was, at the fact that the man would not talk back and give any reason for the blunder he had made.

Now the facts in the case, I learned on investigation, were not with the meter man or with the meter department, but with herself. The front house had been occupied by Martin A. Smith, her father, who had died. Her name was Mary Ann Smith. On the company's books the accounts were carried as M. A. Smith, 419 ———— street, and M. A. Smith, 419½ ———— street. In giving the order for removal of meter she gave the number as 419½ instead of 419. Consequently the meter was taken out correctly as per her request.

This consumer is one of the kind of women that likes to talk. Of course there was a slight annoyance in having her gas shut off, but that was nothing compared to the lack of satisfaction because the company's man would not talk.

From a distribution department, I have an experience that caused considerable annoyance for both gas and electric workers. At an electric manhole it was noticed that every time there was occasion to open the manhole it seemed to be filled with gas and all the while men were at work it was a source of annoyance. Just where this gas came from was hard to determine. Finally it was noticed that on the sidewalk there was a drip pipe. It was also noticed that the iron conduit that ran from the manhole came up on the opposite side of the same pole. These no doubt had both been in use for many years without any trouble occurring. From the position of gas main, drip pot and manhole, and the nearby tracks of the electric railway systems, it is not difficult to determine what took place and how it was that gas got into the manhole and drove the electric man out.

The manufacturing end of our business seems to have reached a state of perfection as I have not received any experiences along that line. However, we all know that the use of California oils and improved generating systems have brought this branch of our business up to a standard that will be hard to improve upon. A member contributes the following which gives a little inside light on present processes:

A complaint came in from a house in ———— that a very bad smell was passing all over the house and a request was made that some one be sent out to look for a leak. The complaint was given immediate attention. A small leak was found at the inlet joint of meter. The woman of the house does her banking business with the Hibernia Bank and this is what she had to say about the manufacture of gas: "And so ye found a leak! did ye! and sure that is what has been making me bill so big! It rotten stuff ye are making and calling gas!" The man at once began to defend the method of manufacture and the quality of gas. "Oh, she said, don't talk to me, young man! I know all about it. Sure my old man works at the gas works and many's the time I have taken his lunch to him down there. He works in the putrefying room and I knows that ye uses ould nasty black oil and shavens, for my ould man do be working thim shavins, so he does." This of course explains the whole process of manufacture from the receipt of the oil in cars at the Works, until it finally passes through the purifying boxes ready to do its work for the housewife.

PANAMA-PACIFIC ELECTRICAL DISTRIBUTION SYSTEM.

An extensive system of mains for the distribution of electric light and power to all the structures of the Panama-Pacific International Exposition has been devised and is now nearly completed, under direction of G. L. Bayley, member American Institute of Electrical Engineers and American Society of Mechanical Engineers, chief of the exposition's department of mechanical and electrical engineering, assisted by L. F. Leury and by Henry Bosch, both members of the American Institute of Electrical Engineers, while the Bureau of Illumination is in charge of W. D. A. Ryan, who was responsible for the excellent illumination at the Hudson-Fulton memorial celebration in New York.

In the main exhibit palaces light will be furnished from 60-cycle, 3-phase, 4-wire mains; having a voltage of approximately 115 between conductors and neutral. The lighting in the other districts, those for concessions and for State and foreign buildings, will be served from 60-cycle, single-phase, 3-wire mains, having a voltage of approximately 115 to neutral and 230 between outside conductors. For power throughout the grounds, 60-cycle, 3-phase and single-phase service at 230 volts, will be available. In addition to alternating current service, there will be mains installed in the Palaces of Machinery, Transportation, Manufactures and Mines and Metallurgy for the distribution of direct current at 125 and 250 volts.

Wattage for patrol, janitor service and lighting of main exhibit palaces was figured on the basis of one-tenth watt per square foot of building area. To this amount has been added an amount estimated to be sufficient to cover the requirements of motors, booth lighting, incandescent decorative lighting and lighting of detached buildings. In the states and foreign government sections the load was based on one watt per square foot of building area, with the building area taken as two-thirds of the total ground area of this district. The average peak load demand of this district, including the live stock exhibit, was taken at 2000 kw. The probable demand of the concessions district has been assumed at 2500 kw.

For the direct current power service in the Palaces of Machinery, Manufactures, Transportation and Mines and Metallurgy, a total of 1000 kw. has been allowed. Direct current service is comtemplated only when the nature of the apparatus absolutely requires it.

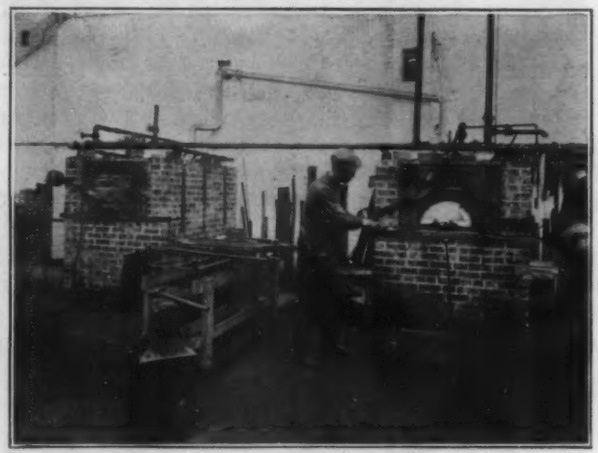
THE INDUSTRIAL FUEL SITUATION.

Why Gas Companies Should Handle Industrial Appliances.

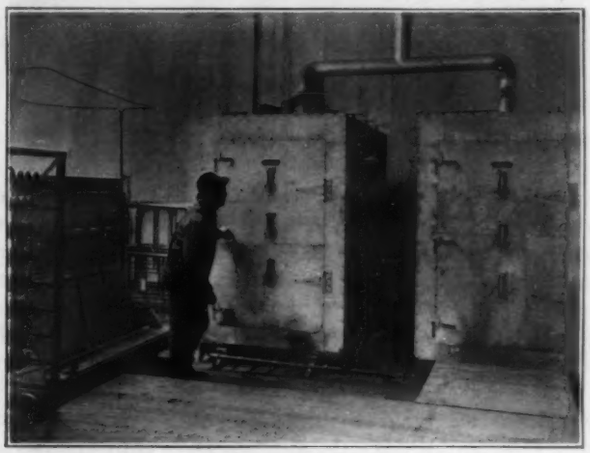
BY JOHN B. REDD.

(This paper was presented before the Pacific Coast Gas Association convention, 1913. The author shows that the sale of gas for industrial fuel purposes is of greatest importance, but as the profit on the sale of the appliances is too small to permit of expert selling on the part of the dealer, the most logical solution is that the gas company handle these in the interests of all.—The Editor.)

Those members who attended the 20th annual convention of the Pacific Coast Gas Association at San Diego, and had the pleasure of hearing Prof. C. L. Cory present his splendid paper entitled "Reasonable Gas Rates" no doubt remember the comparative figures given on the operating expenses of two gas companies in different cities. The daily capacity of these two companies was the same, but the total output of one was practically double that of the other. The former, or more progressive company, could show certain returns upon the capital invested at a rate per thousand cubic feet of gas, which would be absolutely prohibitive to the latter. Prof. Cory stated that for both the stockholders and consumers to derive the greatest benefit from a plant, it would be necessary for the gas company to increase the output in every possible manner, and that he believed the largest increases would come from the correct installation of industrial fuel appliances by the gas companies.



Tempering Furnaces; Temperature 1400° F.



Japanning Ovens Gas Heated to 260° F.

Particularly is this true of the public utilities operating in the Pacific Coast states, where conditions are somewhat different than in other sections, due to the presence of crude oil, a powerful competitor backed by the brains and capital of the oil companies, as well as the oil burner people. The manufacturers of oil burning apparatus are indeed a "live bunch," and are continually improving upon their burners and appliances. Their agents operate in the small towns, as well as the large cities, and find the game comparatively easy where the gas companies fail to go after the industrial fuel business which rightfully belongs to them, and which is awaiting the "live wire" gas salesman. Ripe fruit will rot before your very eyes if you sit in an easy chair and do not go after it. Such is the case with what might be good gas business today, but tomorrow belongs to the oil salesman because of his progressiveness.

Certain business rightfully belongs to the oil people, but I might say that much business which belongs to the gas companies is now in the hands of their competitors. It is up to the gas fraternity of the Pacific Coast states to go after the industrial fuel business and go after it right. We cannot depend upon the appliance dealers to sell industrial appliances and increase our business, as they are only familiar with a few of the appliances and cannot afford the time necessary to make the experiments or tests to secure profitable business. It is often the case that a ten or fifteen dollar burner properly installed will bring in more revenue for the gas company, and give to the consumer results equal to an appliance costing may times that price, but what would be the object of a dealer not directly interested in the gas company endeavoring to sell a burner for a few dollars when there is a possibility of inducing the prospective buyer to purchase a high priced appliance on which the dealer makes a fair profit.

An industrial fuel engineer must necessarily make up special burners or assimilate a combination of burners for a large portion of business obtained. To secure this class of business, the burners must be sold at a reasonable price, and this cannot be the case when the amount charged is figured to offset the cost of labor, material and the salesman's time, all of which must necessarily be added to the sale price by any appliance dealer other than the gas company. Many times a burner of special design is made up for a particular job and the exact style never made use of a second time. To obtain proper results from this end of the business, the gas company, especially in large cities, must maintain an up to date industrial department composed of good salesmen familiar with combustion, ventilation and the various other features necessary in the sale of appliances and the proper operation of same, men who are well up in general manufacturing technique, in position at all times to hold the attention of the prospective consumer, and to give correct information in converting the appliances from other fuels to gas. These men will have to know wood-working, foundry and machine operations, the working of fabrics, the hotel, restaurant and bakery business, the routine of city work, and in fact all classes of businesses. They will have to keep awake twenty-

four hours per day to think of the many new usages for fuel gas.

When a new salesman for the industrial department is needed, select an enthusiastic young fellow from some other department of your company. Encourage him in the work and make him feel free to ask any questions whatsoever pertaining to the business. Each new man should specialize on standard appliances and burners possible to be used by certain classified business until he is not only familiar with the appliances, but is also thoroughly acquainted with the operating details of such business upon which he is working. His work should be changed every few

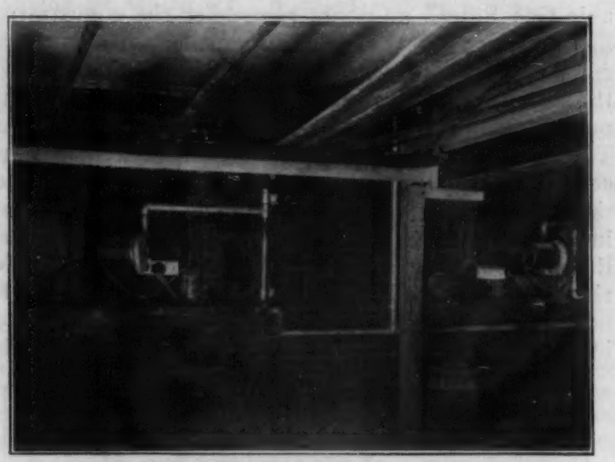
Mount Olivet Crematory Retorts.

months, or as often as the head of the department deems advisable.

The success of an industrial department depends largely in securing the willing co-operation of all of the departments, and the individual support of each employe of the company. This can be accomplished by attending meetings and giving demonstrations of new appliances to all employes, especially those who come in direct contact with the public as representatives of the company, impressing upon them the fact that it is to their own advantage to familiarize themselves with the various appliances. With employes at all times "boosting" gas as a fuel to their friends and acquaintances, many prospects will be found who otherwise would have purchased coal or oil appliances before the industrial department knew of their intention of going into business. The fuel question is interesting to almost everyone, and can be made a live topic of conversation in any company.

There are many manufacturers of fuel appliances, and much care should be exercised in the purchase of same, as money can be saved, both for your company and the consumer. Before new fuel appliances are purchased a thorough understanding should be had with the manufacturer as to the maximum gas consumption per hour and temperatures obtainable. Moderate prices and first-class workmanship should be insisted upon at all times. Many fuel appliances are sold direct to the user by the manufacturer, or through a local agent; neither of these methods are very satisfactory, as a manufacturer has to depend upon unreliable information by letter, and often the agent is unfamiliar with the appliances he is handling, the natural results being a dissatisfied gas consumer and the sale of other gas fuel appliances made more difficult. Relieve the manufacturer of direct sales, and the gas companies will not only profit by being able to purchase first-class appliances at reasonable prices, but the manufacturer will employ additional engineers who will design new types of appliances and increase the efficiency of the old ones to an extent that gas will become recognized by the general public as the best and most economical of fuels.

It has been said that there are no great manufacturing concerns, such as the General Electric Company, the Westinghouse Electric & Manufacturing Company and the Allis-Chalmers Company to prod



Two Blast Bake-Oven Burners.

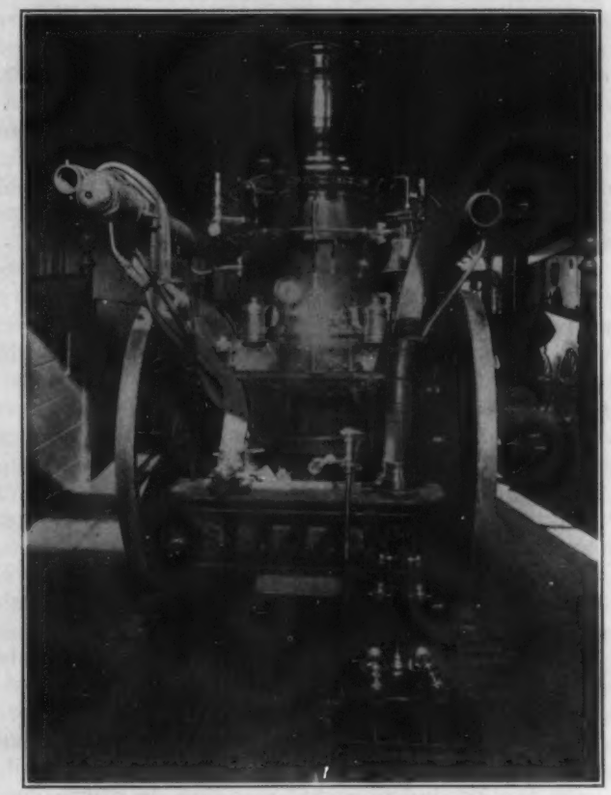
and stimulate the resourcefulness and ingenuity of the promotion department of gas companies. Why is this the case? Because we who are in the gas business have failed to do our utmost in the development of our field. This is clearly demonstrated by the fact that many of the most successful gas appliances now in use have been invented by men other than those in the gas business. Technical training among gas

Gas Burners Used for Varnish Manufacture.

companies has been confined almost entirely to the construction end and to the manufacture of gas. The promotion of sales has been left to men whose whole training has been in the gas business, and who have always heard of ranges and arc lamps, and those things have become the routine of their lives. Let the gas companies spend as much money, energy and earnest-

ness in going after the industrial fuel business as they have in domestic promotion, and every account taken on will pay many times the profit that the company has been accustomed to. The cost of carrying a large account on the ledger is no greater than a meter rental account, less trouble is experienced in collecting the bill and the additional investment in larger meters and services is negligible in comparison with the revenue derived.

The maintenance or up-keep of appliances is a vital feature in assuring constant and satisfied users of gas for fuel purposes, and each installation should be inspected every sixty or ninety days. The cost of maintenance will be more than offset by the sale of additional appliances, besides the consumer will appreciate the attention sufficiently to become a booster for the company and willing at all times to demonstrate his appliances to prospective buyers. Such demonstrations, backed up by a good word from the user, as to results and gas service, will, nine times out of ten, cinch the sale. It would be absurd to think of a dealer properly maintaining appliances without making a profitable charge for the work. The best that some of the dealers give is a defective material guarantee on standard appliances for one year, which is of trifling value to the purchaser as an appliance that cannot be guaranteed for a much longer time than a year should not be recognized as a first-class article by the gas company's representative.



Connections and Gas Burners for Fire Engine.

With the industrial department working in harmony with the manufacturing and distribution departments, and reporting dead meters, choked services, etc., a better gas supply and a more uniform pressure is assured the consumer, which is very necessary to secure proper results from appliances. There may be a sufficient gas supply on the mains at all times, but unless the service fuel lines and meters are of proper size, many poor pressure complaints will be received daily. Complaints of such nature are often handled by inexperienced men working under orders from the foremen to do certain work as quickly as possible and go on to the next job. If the order reads "pump service," the complaint man pumps the service often giving only temporary relief, whereas if he were an experienced appliance man familiar with the capacity of meters and different sizes of pipe, he could advise changes which would give permanent relief and good service. As we cannot afford to have experienced appliance men handling all complaints, it is necessary for the industrial department to keep in close touch with all large fuel installations and to correct any trouble before the consumer becomes dissatisfied with the service. Confidence in gas as a fuel is shown by the gas company handling industrial appliances, and in promotion confidence means the proposition quickly and successfully accomplished. How much more forceful are the arguments of the industrial salesman when he can bring his prospect into a first-class display room and actually demonstrate the gas furnace desired, than when his stock in trade consists of a lot of nerve and a bunch of catalogs. Catalog sales require twice as long to be made, and in many cases by the time the appliance arrives from the factory the purchaser has decided that the old coal or oil furnace is good enough and you have a customer in a much more antagonistic frame of mind to the salesman and the gas company than when he was first approached.

Can we expect the prospective buyer to become enthusiastic over catalog cuts and descriptions of expensive appliances; such as tempering, annealing, tinning, crucible, bronzing, carbonizing, muffle and other types of furnaces, japanning, enameling, drying, sherardizing and bake ovens, rivet heaters, brazing tables, tire and house heaters, branding irons, sterilizers, steam boilers, tool forges, gas engines, butchers' kettles, candy furnaces, batch warmers, incinerators, vulcanizers, water stills, glass and china kilns, industrial burners, and the hundreds of other appliances unfamiliar, not only to the industrial world, but to the majority of gas men. Go yourself into the gas appliance stores and see what information you can obtain upon the appliances mentioned, and then answer the question, who should handle industrial fuel appliances?

For further proof as to the value of an industrial fuel department, I take the liberty of calling your attention to some of the work accomplished by the Industrial Department, San Francisco District, Pacific Gas & Electric Company, since its organization two years ago:

Average Daily Gas Consumption from Industrial Fuel Installations.

	Cu. ft.
75 brick bake ovens converted from wood and oil to gas	90,000
45 fire engines	40,000
Hotel ranges, broilers and restaurant appliances	80,000
Blow torches, soldering furnaces and small blow forges	25,000
27 gas fired steam boilers totaling 98 h.p.	35,000
Tempering, annealing and case hardening furnaces	20,000
Gold, copper, aluminum and soft metal furnaces	47,500
Japanning, enameling and core ovens	22,500
Special burners, house heating and miscellaneous appliances	118,000
Total daily gas consumption	478,000

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Long Live Competition

With the streets of our cities packed with enthusiastic baseball fans, watching the progress, by bulletin, of the world's series, someone startled us with the statement that competition is dead. The comparison is not irrelevant though the one event was in the realm of sport and the other in the camp of the captains of industry. Ask the merchant or average business man about the matter and he will either smile that it "never was keener," or if he has passed that stage, and got onto the wrong track, may but grit his teeth and snap, "Fierce!" Do you mark that line of applicants for the job, though but one man is needed? Ask the rest, whether competition is dead.

Three factory representatives start off on an automobile race from Seattle to San Diego, or somewhere else. At the commencement each has an understanding: Whatever the reason that delays one, the others will co-operate with him in assuring a dead-heat at the finish by being equally delayed. The result is that the "race" degenerates into a turtle trot and the promoters, who may through necessity be the public, bring machines (maybe foreign trade let in by a tariff) from other parts, that the race may be at least interesting to those who pay. Co-operation erroneously took place at the point where competition should have commenced.

Let the same three motorists co-operate at the outset in producing each the best machine that his factory can manufacture and then run their competitive race and it will prove interesting to the public, demonstrate the merits of each machine, and show also whatever of originality or individuality each design possesses. That puts both co-operation and competition in their proper place.

Co-operation should obtain in the perfecting of product and the extension of markets, and competition in the marketing of that product both now and always. Competition far from being dead, is very much alive, and it is well that it is so, for that way lies good business and a nation's prosperity.

In competitive effort, many strive, but one only receives the prize. But here our analogy, like all analogies, proves weak, for in the world of commerce there are many things which appeal to a customer when awarding business. The lowest bidder often fails where quality, individuality, standing or utility succeed, and so on.

We may co-operate to make competition legitimate. It is not legitimate to undersell or otherwise harrass a successful competitor, at the expense of character or with financial loss. Where competition among weak men has caused cut prices, it is found that they are swiftly self-destroyed who fail to realize that the first principles of business demands a fair profit on each transaction.

Competition also eliminates the sluggard, and viewed rightly makes for business, health and acuity.

Competition is a condition, co-operation is different. The spirit of co-operation in business is altruistic, for it implies both giving and receiving. It means that competitors even, tell each other the how, why, when and where of their accomplishment. Tell it without hope of reward and sometimes at an immediate sacrifice. It makes competition more keen, but robs it of its sting. If you have felt the sting of competition

in the past it is the result of wrong action—fighting your competitors instead of fighting for the business; but as long as human nature continues, so long will competition, for while co-opertion may make for a better understanding and basis, it is not business, but only a means to that end.

Persistent over-production is a result of mismanagement and is not a legitimate excuse for centralization or consolidation that prices may be raised to meet that condition. This is not co-operation and certainly will not kill competition. To produce to a point beyond the demand is to telephone for the receiver, unless through co-operation you create for that surplus a new market.

Educate the public, educate your sales force, and through quality, originality, the usefulness and individuality of your product, press right up to the front, and you will find pleasure in displacing the death dirge with the paen of promise: "Competition is dead! Long live Competition!"

The Point of View

Getting the other man's point of view is apparently as difficult in our time as in the days of knighthood. Two mounted knights approaching each other from east and west halted on the highway a few yards on either side of a suspended shield which indicated the name of mine host's inn.

"What a pretty silver shield," hailed he from the East. "'Tis gilded," said he of the West. "You are mistaken." And thereupon ensued an interesting discussion which ended in each riding at the other and due to the shock of contact they became unhorsed each in the place previously occupied by the other, and from this new view-point, each looking up at the shield, acknowledged he was wrong, for they had stopped at "Ye Sign of the Gold and Silver Shield," which was silver toward the East and gilded to the West.

Truly a thought is not our own until we tell it to another when it is either confirmed or confounded, but in either case, our own store of knowledge is enriched.

Depreciation

The subject of depreciation is admittedly of prime importance to the public utilities executive whether he desires the information in order to arrive at a satisfactory method of rate-making, or to justify, before a public service commission rates already made, in connection with which this factor looms so large.

Invention which causes plant reconstruction and replacement long before the old has worn out that the company may give better service or produce with increased efficiency, makes it well nigh impossible to estimate this item with precision. There seems to be a myriad other factors which enter also, and different angles from which to view each of these that may be properly interpreted.

The statistical estimate is a scientific procedure which looks to the constancy of laws for its accuracy, but in the gas and electrical industries progress with its unceasing change is also constant and the statistical determination of some items is almost impossible. This is especially true of the item of depreciation.

It is equally difficult to apply the same laws of depreciation or obsolescency to places of different geographical location. For example, to a place where an abundance of natural gas has been discovered as compared with that depending upon perpetual coal, or again, to that place where coal has been displaced by oil in the manufacture of gas. Then again the destruction of plant and property through fire or the forces of nature might also enter to disrupt the most carefully made estimates of depreciation; and such cases might be multiplied.

Public utilities should be permitted to carry a sufficiently large reserve fund to care for contingencies, but when this has been done, and chance eliminated as far as can be, there must still obtain a theoretical basis closely approximating the actual which may be used in arriving at a proper conception of depreciation and similar items obscured in the maze of counter considerations of high finance.

Much valuable work has been done by Dr. Alex. Humphrey, whose papers presented before the Pacific Coast Gas Association and the British Gas Institute are appearing in this issue, in arriving at just what factors enter into a discussion of this subject and the best methods of determining what the item of depreciation actually is.

The Cost of Service

The successful laying of the Gulf of Georgia submarine telephone cable, described in this issue, added another world-beating record to the credit of the Pacific Coast. The cable is in deeper water than any other continuously loaded telephone cable, and at its greatest depth, 1380 ft., the pressure is nearly 600 lb. per sq. in.

Telephone experts the world over watched with great interest the laying of this cable, for it is the longest submarine telephone cable of its kind. The principle of the system in use on the new cable was discovered by Krarup, a Danish telephone operator. The installation is said to be entirely successful.

Those who tried to speak over the now displaced cable and land line will appreciate the value of this new cable purchased and laid by expert engineers as compared with the old "telegraph" cable which it was stated was bought in the open market by one of the directors. Of course, the art has progressed also, and much credit is due the directors of the British Columbia Telephone Company for the spirit in which they discarded the old line and installed such an excellent new one, in order to give better service.

The expenditure of a quarter million dollars for improved service does not impress us as it should, for familiarity is breeding an indifference to the meaning of figures and the immensity of amounts.

We read indifferently that $55,000 is to be spent for a short underground conduit system to replace an aerial which a fastidious public has condemned, $60,000 to be expended for rebuilding 23 miles of toll line between two cities to increase efficiency and then $250,000 for the Gulf of Georgia submarine telephone cable in order that better service be secured. As public utility improvements go, these amounts too are comparatively small.

As already stated, service is the incentive to this expenditure which, however, stands also for progress, increased profits, and greater satisfaction to all.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

H. E. Plank, General Electric Company, Seattle, is on a trip East.

Miles F. Steel, Benjamin Electric Manufacturing Company, is at Spokane.

J. O. Presbey, Holophane Works of G. E. Co., was at Salt Lake City during the past week.

Mortimer Fleishhaker, Great Western Power Company, has left for a trip throughout the East.

A. P. Peck, Electric Supply Company, Sacramento, was at San Francisco during the past week.

Wm. Bromley, manager Ukiah Electric System, was a visitor at San Francisco during the past week.

E. C. McBrearty, Detroit Electrical Heater Company, is at San Francisco and will also make other coast cities.

T. L. Nightingale of the Electrical Supply Company, Sacramento, has returned from a six weeks' business and pleasure trip to New York.

Sylvester A. Baker, McBeth, Evans Glass Company, is at Portland, Ore., and will visit other northwest and British Columbia cities.

Ralph Phelps, the Safety Insulated Wire Company's popular representative, excelled at the Portola Festival as Vasco Nunez de Balboa.

J. V. Schneider of the Western Electric Company, San Francisco, recently returned from a several day's business trip through Northern California.

Hugh McPhee, electrical commercial superintendent, and **L. Mesmer**, plant superintendent of the Western Union Telegraph Company, were at Yuma recently.

L. C. Helfrich, purchasing agent, Coast Valleys Gas & Elcctric Company, has returned to the head office after having visited the branch offices of the company.

W. H. Trask Jr., commercial agent, Idaho Railway, Light and Power Company of Boise, Idaho, is a Salt Lake visitor on his way to Denver, where he will take a short vacation.

J. T. Ryan, valuation engineer, J. G. White Engineering Corporation, was at Santa Barbara and gave expert testimony in re the case of the Santa Barbara Gas & Electric Company.

J. E. Stevenot, Philippine General Electric Company, was at San Francisco last week, having returned from an extended trip through the East. Mr. Stevenot will return home via British Columbia.

Col. H. V. Carter, president Pacific States Electric Company, **T. E. Bibbins**, manager General Electric Company, San Francisco, and **Mr. Lillard** of the Gould Storage Battery Company, are taking a vacation motoring.

W. F. Cozad, a director of the Colorado Electric Club, was a visitor at the Thursday luncheon of the Utah Electric Club. At the request of the chairman, Mr. Cozad outlined briefly the work of the Colorado Club and their experience in various matters.

Frank W. Loomis, sales manager electrical department H. W. Johns-Manville Company, Seattle, has been appointed to take charge of the Illuminating Engineering department of the company at Milwaukee. Mr. Loomis was previously connected with the Holophane Works of General Electric Company.

Wm. C. Beatty of the United States Reclamation Service, electrical engineering department, on the Rio Grande project, in New Mexico, is at Los Angeles. Mr. Beatty was formerly connected with the Tracy Engineering Company of Los Angeles.

D. R. Kennedy passed through San Francisco en route to Riverside, Cal., where he will occupy the position of superintendent of power houses for the Southern Sierras Power Company. Mr. Kennedy was previously with the British Columbia Electric Railway Company at Vancouver, B. C., and had charge of the high tension system.

Andrew N. Fox, who is conducting a 20 weeks' course in advertising at the Chicago, Y. M. C. A., is singularly qualified to make a great success of this course which is intended to give students a sound knowledge of the underlying princi-

Andrew N. Fox, Advertising Manager Benjamin Electric Co., Chicago, Ill.

ples being followed in the production of successful advertising. Mr. Fox is advertising manager, Benjamin Electric Manufacturing Company, a director Chicago Advertising Association, vice-president Central Division and member Board of Lecturers Associated Advertising Clubs of America.

MEETING NOTICES.

San Francisco Electrical Development and Jovian League.

The regular weekly luncheon was held at Tait's Cafe. An appropriate address on "The Life and Works of Edison," was read by Frank D. Fagan, lamp specialist, General Electric Company, San Francisco, the meeting occurring on Edison Day, October 21, 1913, the 34th anniversary of the birth of Edison's carbon filament incandescent lamp.

San Francisco Chamber of Commerce.

As the guest of the San Francisco Chamber of Commerce, the local Electrical Development and Jovian League attended a smoker at the Commercial Club on October 20th. The feature of the evening was an address on "Co-operation," by Mr. Edward C. Trefz, field secretary of the Chamber of Commerce of the United States of America. Mr. Trefz is a speaker of rare merit and his excellent address further ensured the success of the meeting. Other speakers were Frederick Whitton, Col. Geo. H. Pippy, Wm. R. Wheeler, Geo. I. Chase, F. B. Conley, Frederick J. Koster.

Utah Electric Club.

At the regular Thursday luncheon of the Utah Electric Club, Malcolm McAllister, advertising expert, discussed the subject, "The Salesman—the One Best Advertisement." Mr. McAllister claimed that few printed ads really sell the goods. The best a printed advertisement can do in general is to attract attention and arouse a desire to purchase. In most cases the deal must be closed by the salesman. If the sale is not made right, it is often not made to stay, so that the improper selling methods may undo all of the work of an expensive advertising campaign. On the other hand, proper selling methods co-operating with an intelligent aggressive advertising campaign form the best business getting team.

Portland A. I. E. E. and N. E. L. A.

The Joint Committee of the local section of the A. I. E. E. and N. E. L. A. has arranged an interesting program for the ensuing season. Papers will be presented by B. C. Condit, chief electrical engineer, Northwestern Electric Company, by O. B. Coldwell, superintendent Light & Power Department, Portland Railway, Light & Power Company, by P. Lebenbaum, electrical engineer, Portland Railway, Light & Power Company, on "Railway Electrification," and by F. D. Weber, electrical inspector, U. E. R. Bureau, on the question "Is it necessary to have Underwriters' Inspection in Oregon?" The fol-

lowing papers have also been prepared: "Outdoor Substations," by D. F. McGee, electrical engineer, Pacific Light & Power Company; "Hydroelectric Development," by L. F. Harza, consulting engineer, and on "Fault Location," by H. M. Friendly, electrical engineer.

"The Principles and Phenomena of Wireless Transmission," by Prof Elihu Thomson, "Electricity in the Construction and Operation of the Panama Canal," D. B. Rushmore, and a lecture by Ralph D. Mershon on "Some Things Engineers Should Know concerning the Rudiments of Corporation Finance," available from the lecture bureau of the National Electric Light Association will also be given.

The active committee members in charge of this program are F. M. Friendly and W. H. Evans, representing the A. I. E. E., R. H. Fisher and J C. Martin, representing the N. E. L. A., and E. H. Le Tourneau connected with both associations.

Eleventh Jovian Congress.

The eleventh annual meeting of the Jovian Order was held at the Hotel Astor, New York City, October 14th to 16th. In many respects it proved one of the most momentous yet held, largely because of certain changes in scope which should greatly enhance the practical value of the organization to every member. Over one-fourth of the entire membership of twelve thousand was represented in person or by proxy, which insured the election of W. N. Matthews of St. Louis as twelfth reigning Jupiter.

The convention was opened on Tuesday morning, October 14th, with Statesman Jos. F. Becker in the chair, to introduce Jupiter Frank F. Watts, who delivered a graceful address of welcome. The response was given by H. F. MacGregor, Past Jupiter No. 2, after which Jupiter Watts called Henry Harris to preside over the remaining business sessions. As those were devoted largely to matters not to be revealed to the uninitiated, only a brief summary of some of the results can be published.

The report of Mercury E. C. Bennett showed that all previous records for increase in membership had been surpassed during Jupiter Watt's administration, over 3800 new members having been admitted during the past year, giving a present net membership of 11,587. The best individual record was made by Statesman Frank D. Beardslee of St. Louis with a total of 466, of which 285 were in one class, the largest single class on record. Mercury's report contained a series of valuable suggestions, most of which were adopted.

Of these the most vital is the establishment of a commercial division of the central office under the management of E. C. Bennett, who will also supervise the social division. The purpose is to devise ways and means whereby the local Jovian Leagues can accomplish more practical work of direct benefit to the electrical industry. Co-operative electrical display rooms are to be established, an employment bureau maintained, speakers to be provided, better legislation is to be fostered, co-operation of architects to be secured, and similar plans to be fixed by the twelfth congress.

A new district was established in Canada and the office of Triton instituted to provide an additional Congressman. The former method of voting by states instead of by proxy was adopted, a new degree of Stentor prescribed and important changes made in the ritual. Hereafter Jovian Day will be celebrated on the third Tuesday of September and university students in electrical engineering may be admitted.

At the annual election of officers on Thursday morning the report of the nominating committee was unanimously adopted and the following members of the Twelfth Jovian Congress elected:

Jupiter, W. N. Matthews, St. Louis, Mo.
Neptune, M. F. Knapp, Pittsburg.
Pluto, Tom Bibber, New York City.
Vulcan, A. H. Halloran, San Francisco, Cal.
Avrenim—L. V. Noguira, Dallas.
Hercules, Geo. C. Rough, Toronto, Canada.
Mars, E. A. Wilcox, Boise, Idaho.
Apollo, Geo. C. Richards, Chicago.
Triton, M. H. Jones, Baltimore, Md.
Mercury, E. C. Bennett, St. Louis, Mo.

The following Chief Stentors were also elected: Tom Bibber, H. H. Cudmore, Perry Boole, Sam A. Hobson, H. E. Sanderson.

Degrees of merit were awarded to many members, including all Pacific Coast statesmen and statesmen-at-large.

At the Co-operative Session on Thursday morning Chas. L. Eidlitz gave a straight-from-the-shoulder analysis of the troubles in the electrical business, which he claimed is not ordinarily conducted on the strict principles as regards price and credits as in other industries. Henry L. Doherty, president of the Society for Electrical Development, told of the aims and efforts of this organized plan "to do it electrically." Papers were also read by Jas. H. Collins and Dr. Lee Galloway. Wednesday's entertainment features included a Jovian Lunch, the competitive degree team work and the annual rejuvenation. Two teams entered the competition, that of the National Carbon Company from Cleveland under Statesman M. H. Moffett and that of New York, under Statesman Jos. F. Becker. The committee of Past Jupiters finally awarded the prize to the excellent work of the New York team, also giving most complimentary notice to the work of the Cleveland team.

At the annual rejuvenation nearly 200 candidates were admitted. The New York team introduced a novelty by appearing in dress suits instead of the usual costumes. The ceremony was followed by a smoker and supper with vaudeville entertainment, all given by the New York Edison Company.

The annual banquet on Thursday evening in the grand ballroom of the Hotel Astor was one of the most magnificent affairs yet given by the Jovians. The elaborateness of the appointments was exceeded only by that of the menu and too much credit cannot be given to the committee having it in charge. As the cigars were produced the ladies were admitted to the balcony so that they also might enjoy the feast of reason which followed. This feature of admitting the ladies was but the culmination of the continual round of entertainment provided for them. Lunches, automobile rides, theatre parties, dinners and other entertainment was provided so that every moment of their time was occupied.

Portland Electric Club.

"Mike" Conley, a veteran trackman of the Portland Railway, Light & Power Company, and Franklin T. Griffith, president of the company, marched arm-in-arm at the opening meeting of the Electric Club and occupied seats assigned for those who had served the company for 20 years or more. They were followed by 53 others. The assembly hall was filled with some 300 members. F. D. Hunt acted as chairman. A unique form of presenting those who had seen long service in the company was adopted. All belonging to the 20-year class were placed in an anteroom and when the members were seated the honored guests were marched to the platform in pairs. When the 55 honored guests had been seated, a drop curtain was lowered along the wall having printed on it in large letters, "Twenty Years of Service." The orchestra played "Auld Lang Syne" with the audience joining in. It was an impressive scene and the cheers betokened the feelings of all.

A stereopticon showed pictures of the early period of Portland. There were views of 1851, 1856, 1877, 1885, 1890 and 1913, pictures of President Griffith as he looked twenty years ago and today. This was followed by scenes of early day streetcar operation in Portland. Pictures of horse cars conducted by Ben Holladay, the steam dummies of Sunnyside, Mount Tabor and Mount Scott, the cable line to Portland Heights, and then the obsolete trolley with finally an up-to-

date pay-as-you-enter car, which is in use today. There were, besides many old-time scenes, wherein the employes figured as participants, such as the flood of 1894, the wreck of the Nineteenth and Washington street barns and the Vancouver ferry.

C. F. Swigert, former president of the City & Suburban Railway, gave a brief address. He declared that streetcar operation in the early day was fraught with many disappointments and very few rewards. Pioneers in this particular line of endeavor lost money readily enough and furnished transportation at less than it cost when all factors were taken into consideration. The development, he said, was entirely too fast to deliver a profit for the reason that machinery was discarded before its usefulness was entirely gone, to make room for a more efficient and more recently invented machine. He told of the day in crossing the river long before the bridges were found to be a necessity and how the swamps which have long disappeared from the east bank of the river formed an almost impassable barrier to construction of railways connecting the east and west sides.

Franklin T. Griffith, president of the company, devoted some time to recalling the rapid changes in equipment which had taken place in a very brief time. "While the changes in the early period were fast and furious they were as nothing compared with the changes which came with the application of electricity as a means for motive power," he said. "The junk heap today testifies to the rapid progress of this industry. Much of it represents an investment, which came as the result of blazing the way for an up-to-date transportation company. All of the machinery discarded to make room for newer and more effective pieces is represented by capital investment and is only part of the burden which falls on all business alike in the effort to establish a paying concern, and leads to the conclusion that there are many things to be considered outside of the bare physical value of a plant. The transportation system of Portland and its electric lighting was only made possible by the work of Swigert, Campbell and Fuller in the railroad line and Eastman, Morey and Goode in the electric line."

F. I. Fuller, "Mike" Conley, Fred Cooper, O. B. Coldwell and A. H. Richmond gave brief addresses, after which the members partook of refreshments.

American Institute Electrical Engineers.

At the regular monthly meeting of the board of directors of the American Institute of Electrical Engineers held in New York on Friday, October 10, 1913, at 3:30 p. m. President Mailloux was authorized to change the organization of the Electric Power Committee by substituting for the subcommittee on prime movers, a committee on power generation, and to make the committee on prime movers an independent committee. President Mailloux announced the following additional committee appointments: Power Generation: H. W. Buck, chairman; Allan V. Garrett, F. G. Gasche, Daniel W. Mead, S. D. Sprong. Committee on Technical Lectures: W I. Slichter, chairman; W. A. Del Mar, secretary; W. S. Rugg, L. T. Robinson, John B. Whitehead. Committee on Engineering Co-operation: William McClellan, chairman; H. H. Barnes, Jr., A. W. Berresford, Charles E. Scribner, S. D. Sprong.

Upon the petition of the Panama members of the Institute, and the recommendation of the sections committee, authority was granted to organize an Institute Section in the Canal Zone, to be known as the Panama Section.

In response to an invitation from the National Conservation Congress, the president was authorized to appoint five delegates to represent the Institute at the Fifth National Conservation Congress, to be held in Washington, November 18-20, 1913

Upon the recommendation of the executive committee of the International Electrical Congress, President Mailloux was authorized to recognize the executive committee with a chairman and vice-chairman, with the several members of the committee, serving also as chairman of the necessary sub-committees. The personnel of the committee as reorganized will be announced later. The executive committee of the committee on organization of the International Electrical Congress, San Francisco, 1915, reported that it had unanimously decided to invite Dr. Charles P. Steinmetz to accept the position of honorary president of the congress and Dr. E. B. Rosa to accept the position of honorary secretary of the congress. This action was unanimously approved and confirmed by the board of directors.

TRADE NOTES.

Mr. Van E. Britton announces the removal of his office to room 501 Grant Building, Market street, San Francisco.

The following are among recent orders received by the Westinghouse Electric & Manufacturing Company:

S. S. Bullis, Medford, Ore. One synchronous motor generator set consisting of 600-volt, D. C. generator and 2200-volt, 3-phase, 60-cycle synchronous motor with one switchboard for the control of same.

Oakland, Antioch & Eastern Railway Company, Oakland, Cal. One 750-k.w., synchronous motor generator set consisting of two 650-volt D. C. generators connected in series, and 11,000-volt, 3-phase, 60-cycle, 514 r.p.m motor with direct connected exciter.

It is estimated that between 400 and 500 electric vehicles are in service in or within a short distance of Los Angeles. Quite a number of these are equipped with Edison storage batteries. This is particularly true of the commercial vehicles, one of the large power companies having twenty commercial electrics in regular service, all of which, so equipped, operate at a cost of 50 per cent or better in saving over that of gasoline cars in similar service.

NEWS OF CALIFORNIA RAILROAD COMMISSION.

A decision was rendered granting authority to A. A. Weber to sell to the Alta District Gas Company a gas plant serving the cities of Dinuba and Reedley, and authorizing the gas company to operate under franchises in Tulare and Fresno counties. The company was also authorized to issue $20,000 of notes.

The San Rafael and San Anselmo Valley Railway Company applied for authority to issue $10,000 in stocks and $100,000 in bonds for the purpose of new construction.

Authority was granted to George W. Kitchen to sell his gas plant in Madera to the Madera Gas Company. The Madera Gas Company was given permission to issue $25,000 of bonds and $14,000 of stock.

The Tulare County Power Company was granted authority to issue $250,000 of notes and $33,000 of stock for the purpose of liquidating the company's indebtedness.

A decision was rendered granting authority to the Fresno-Hanford & Summit Lake Interurban Railway Company to issue $225,000 of stock.

The Hemet-San Jacinto Gas Company was granted authority to issue $3,000 in bonds for the purpose of purchasing new machinery.

Henry P. Kyes was granted authority to sell his water system to the city of Riverside for $15,000.

The Riverside Artesia Water Company was granted authority to sell its water system to the city of Riverside for $195,000.

The Commission issued a general order directing all steam and electric railways of the State to provide sanitary individual drinking cups for passengers at a cost not to exceed one cent per cup. These cups must be provided on all trains whose schedule between terminals exceeds one hour and thirty minutes.

NEWS NOTES

FINANCIAL.

WOODLAND, CAL.—Articles of incorporation of the Winters Gas Company have been filed in the office of the county clerk. The purposes as stated are to build, own and equip a gas plant, and to distribute gas to the town of Winters. The incorporation is for $50,000, stock being of 5000 shares of a par value of $10 each. The incorporators are: C. A. Erwin and Allen Stark of Winters, and W. W. Collins of Woodland, each of whom has subscribed for five shares of stock.

LOS ANGELES, CAL.—To pay the interest on the securities issued in connection with the Big Creek development, the Pacific Light & Power Corporation requires $650,000 a year. The company is now earning sufficient to provide for this interest and leave a balance of $175,000. This balance would be enough to also pay the interest on the $2,388,000 six per cent bonds of the Southern California Gas Company, which are paid by that corporation, a subsidiary of Pacific Light & Power Corporation.

ILLUMINATION.

GALLUP, N. M.—People's Light & Power Company has been granted a franchise to furnish electricity for power, heating and lighting purposes to town of Gallup and residents.

ALBANY, ORE.—G. L. Rauch of Portland has been granted another gas franchise by the city council. The first franchise became void in default of the filing of the bonds within the time limit.

SAN FRANCISCO, CAL.—The Coast Valleys Gas and Electric Company has applied to the commission for authority to issue $114,000 of bonds. The money is desired to pay existing indebtedness of the corporation.

PORTLAND, ORE.—Rules have been issued by the Oregon Railroad Commission governing the installation by public utilities of gas, electric and water meters, the quality of service to be supplied and the charging of deposits to consumers.

ASHLAND, ORE.—H. G. Butterfield submitted a petition to the council asking for a $25,000 bond issue to build an auxiliary electric light plant at the lower instake, to cost $16,000. The communication was referred to the city council, meeting to be held subject to the call of the mayor.

SAN FRANCISCO, CAL.—The Light and Power Council, which engineered the late strike against the Pacific Gas & Electric Company, has filed a petition in the State Court of Appeals asking that the city be compelled to show cause why it should not, through the Supervisors, regulate the rates for the sale of illuminating gas.

SEATTLE, WASH.—A resolution has been passed providing for the installation of a system of cluster lights on Fifth avenue, Bell, Battery, Wall, Vine and Cedar streets, with poles, conduits, wires and other appurtenances as may be necessary, according to plans to be pdepared by the city engineer. Cost will be assessed against the property.

LOS ANGELES, CAL.—Notice of sale of franchise sought by Pacific Light & Power Corporation has been withdrawn by board of supervisors because proposed franchise did not provide that in event of consolidation of territory covered by grant with city or town municipality shall have right to purchase. Supervisors postponed action for two weeks.

SAN FRANCISCO, CAL.—For the Portola Festival many thousand special decorative street lighting Mazda lamps will be used, aggregating one million candle-power. This does not include the special lighting installed by other than the Portola committee. The large bell of lamps installed on Market street is 200 ft. high, and 120 ft. in diameter at the lower rim, which is just above the trolley wires. An electric fountain in Union Square is also a feature of the festival.

SALT LAKE CITY, UTAH.—Unless the Supreme Court overrules the decision of Judge Fred C. Loofbourow, the Utah Light & Railway Company will have to pay a meter tax of $1 per year on each meter in service to comply with the ordinance passed by the city council during 1910. The electric company refused to pay the tax on the ground that it was unconstitutional. The city carried the matter to the courts and the decision of Judge Loofbourow last week closed the first round in the legal battle which ensued. It is understood the company will appeal the case to the Supreme Court.

SALT LAKE CITY, UTAH.—At a luncheon given last week by the Utah Light & Railway Company to representatives of the electrical manufacturers, jobbers, contractors and supply dealers, General Manager Joseph S. Wells, Commercial Agent Bayard W. Mendenhall and Auditor Will Browne explained that the company plans to open an electric shop and commercial office in the heart of the shopping district, and outlined that it would be the policy in the future, as it has been in the past, to co-operate fully with all electrical interests, particularly the supply dealer and contractor, who might fear injury to their business if the central station company should adopt a price-cutting policy. Aside from pushing the sale of electric ranges and similar appliances for which the market now is limited, the company proposes to maintain such retail prices as will enable small dealers to do business at a profit, and believes that the additional business created will more than offset any business taken away from the other electric stores.

TELEPHONE AND TELEGRAPH.

PHOENIX, ARIZ.—Plans are being drawn for rebuilding of the Mountain States Telephone Company's system in the valley and for extension of the system in the city.

BLYTHE, CAL.—S. D. Kamran has been granted a franchise for telephone and telegraph system and to maintain same for a period of 50 years over certain streets, public places and highways in Blythe.

SAN DIEGO, CAL.—The San Diego Home Telephone Company has applied to the commission for leave to issue notes in the sum of $150,000 for the purpose of paying existing indebtedness, and for making additions and betterments to its system.

DOWNIEVILLE, CAL.—The Pacific States Telephone & Telegraph Company is erecting a new line from Nevada City to Downieville. The workmen are now at Goodyear's Bar, four miles from here, installing a heavy No. 6 galvanized wire, which will insure connection with the outside world in the winter time.

VANCOUVER, B. C.—That the Canadian Government intends making an early start on the construction of a telegraph line from Clayoquot to Friendly Cove, on the west coast of Vancouver Island, is affirmed in a statement made by J. T. Phelan, superintendent of telegraphs for the Canadian Government at Vancouver. The line will be extended to other points.

LOS ANGELES, CAL.—The Pacific Telephone & Telegraph Company is having plans prepared for a Class A building, to be erected on property on Hill street, between Sixth and Seventh streets, to cost about $130,000. New toll switchboard of larger capacity has been ordered, and will be installed in the new building. This toll board will require an outlay of about $100,000. Owing to the heavy increase in traffic between Los Angeles and San Diego and other cities, it has been arranged to provide two additional circuits be-

tween Los Angeles and San Diego. This with two additional circuits between Corona and Elsinore, and three additional circuits between Riverside and Corona, will involve an expenditure of about $62,000.

TRANSMISSION.

HELENA, MONT.—An application for permission to install and operate another electric power generating plant in Helena has been presented to the city council by the Standard Engineering Company. The petition was signed by A. L. Goldschmidt, secretary of the corporation, and was referred to the committee of street railways and electric lights.

SEATTLE, WASH.—The Washington State Public Service Commission has set November 3 for an open informal hearing in Seattle on the proposed rules and regulations to govern the overhead electrical construction provisions of the law passed by the last legislature. Invitations have been extended to all the electrical companies and electrical workers' unions to be present.

LOS ANGELES, CAL.—The Big Creek development of the Pacific Light & Power Corporation is expected to be in partial operation by January 1, 1914, and will at once add largely to the earning power of the company, in addition to decreasing operating expense. By use of the hydroelectric power the company will be able to close down steam stations, which will be held in reserve, and use the cheaply generated hydroelectric power for distribution in the Los Angeles territory.

WOODLAND, CAL.—To offset a petition being signed at Lakeport and Upper Lake, remonstrating against the granting of the application of the Yolo Water & Power Company to use the waters of Cache Creek for power purposes, by the State Water Commission, another petition is being circulated here. The local petition is directed to the Water Commission of the State, that the prosperity of the people of Yolo County depends in a large measure upon the success of the plans of the Yolo Water & Power Company.

TRANSPORTATION.

VICTORIA, B. C.—A company which is being formed to operate motor busses in this city plans also to build their own vehicles here.

HELENA, MONT.—The campaign for the construction of an interurban electric line out of Helena through the valley has been started. John D. Ryan has agreed to subscribe $50,000 providing Helena raises a like sum. Frank J. Edwards is chairman of the committee.

STOCKTON, CAL.—The Stockton Terminal & Eastern Railway Company has applied to the commission for permission to issue bonds in the sum of $15,000. It desires to pledge $10,000 as security for loans, and proposes with the balance to provide necessary ballasting.

SAN FRANCISCO, CAL.—Judge Murasky holds that the "intersection" is the outer line of the street and not the center of it, and has ruled that the Post street franchise of the United Railroads extends to the outer line of Market street only, and therefore the company cannot run its Post street cars down Market street.

SEATTLE, WASH.—The City Council has passed and Mayor Cotterill signed an ordinance accepting as an unincumbered gift the Lake Burien car line, a trolley road extending from South Park to Lake Burien. It was built by property owners to develop land south of the city. It is proposed to extend the line north to the center of Seattle and south of the Three-tree point, where connection may be made with a ferry to Vashon island.

PORTLAND, ORE.—Considerable interest was centered in the trial run of the Ewbank motor car, which promises a revolution in heavy traction power methods. The electric motive power is generated within the car, distillate being used for fuel. The car equipment is electrically the same as on a trolley car except that the energy is obtained from a dynamo on the front end of the car. The run is said to have been entirely successful.

VALLEJO, CAL.—James Grace of the Northern Electric Railway Company is now engaged in securing right of way preparatory to the construction of the road between Fairfield and this city, the last stretch necessary to complete the line to Sacramento. A branch line which will leave the Fairfield-Vallejo road at Napa Junction and run north to the city of Napa, is also to be built immediately, and it is largely in connection with these rights of way that Grace is now here.

SAN FRANCISCO, CAL.—A. M. Mortenson, traffic manager of the Exposition, has filed his first tariff of the Exposition Terminal Railway with the commission. The charge for switching carload shipments from car barge at the freight slip of this company to any point within the grounds reached by the company's rails will be $10 per carload. This covers the return of the empty car to the car barge. For switching carload or less than carload shipments from one point within the grounds, except from car barge at freight slip, to any other point a charge of $5 per carload will be made.

LOS ANGELES, CAL.—The Commission has ordered that the Pacific Electric Railway Company submit for the approval of this commission a plan for the instructing, training, examining and testing of its employes, and plan of an automatic block signal and staff signal system, covering its entire system outside of city limits, including the location, type and estimates of cost of such signaling system; and a statement showing the location of all crossings of its tracks by roads or highways, what, if any, protection or warning is provided at such crossings; and a further statement showing the location of crossings of main line tracks by other main line tracks, the protection against collisions which now exists at such crossings, together with estimates of the cost of instaling at all such crossings adequate interlocking plants.

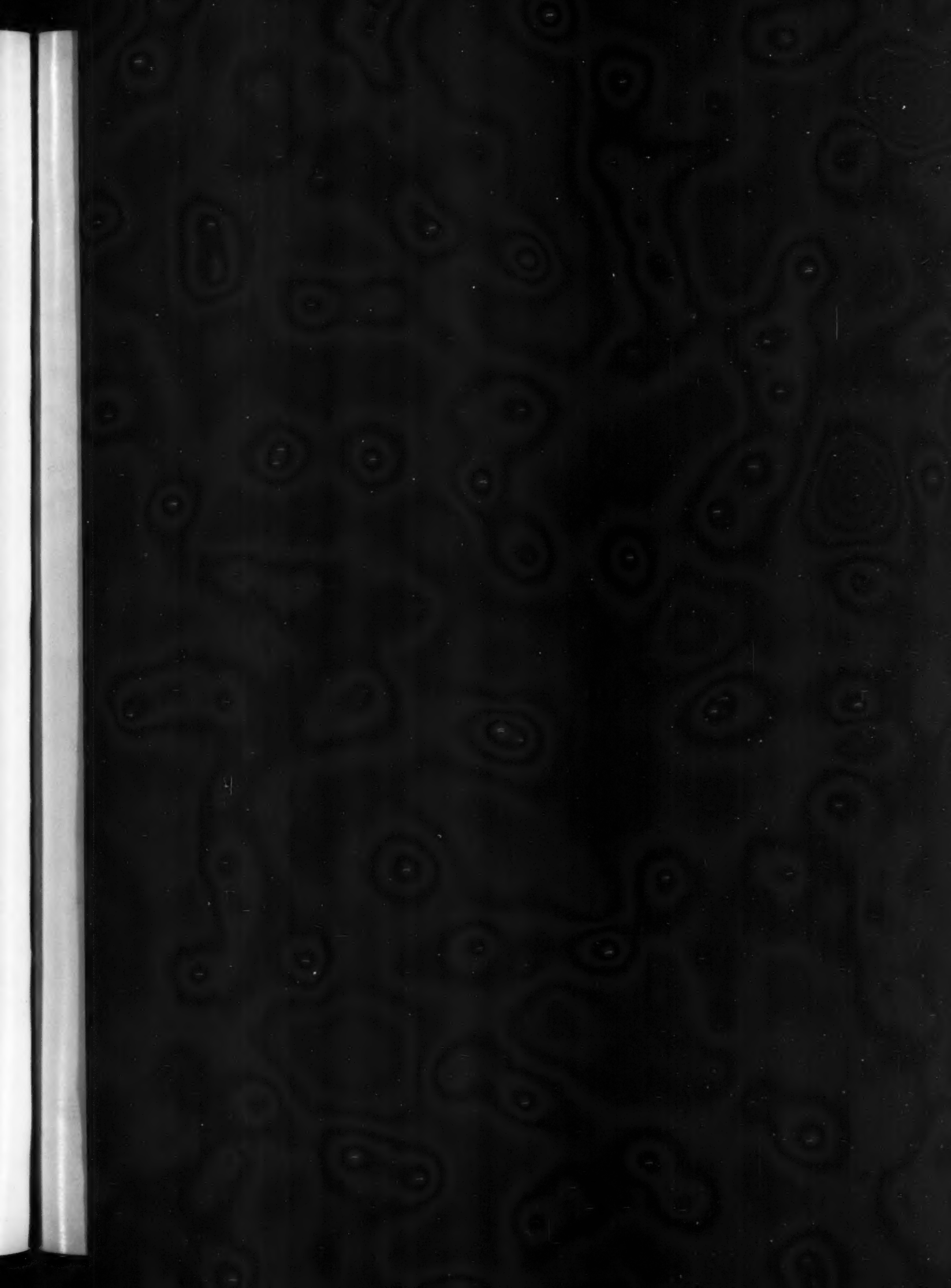
WATERWORKS.

SUPERIOR, ARIZ.—According to Mr. Kellner, new water works are being planned for this town. The plans call for bringing water from two lakes located on Queen Creek. Work of piping will begin in the near future.

DALY CITY, CAL.—The clerk opened the bids for the construction of the main line of the water system to be laid along the Mission road, including all connections. The Contra Costa Construction Company was awarded the contract on its bid of $8900.

BAKER CITY, ORE.—Director Frank Gardiner of the Baker Commercial Club reported the cost of the construction of a 12-in. steel pipe line from the reservoir to South Baker to be about $37,500 for the necessary 12,600 ft. of 12-in. steel pipe. He asked the club to endorse a petition on the matter.

RICHMOND, CAL.—The members of the Richmond municipal water district at a recent meeting held in the city council chamber of the city hall, issued instructions to City Attorney Hall to begin preparations for the calling of an election to raise $2,500,000 with which to construct a municipal water system for this city.

SAN FRANCISCO, CAL.—A meeting of the stockholders of the Spring Valley Water Company has been called for Friday, December 19, to vote upon the proposition to increase the bonded debt from $28,000,000 to $30,000,000, the proposed increase to be represented by two-year 5½ per cent notes, payable semi-annually, and secured by pledge of bonds.

SAN FRANCISCO, CAL.—The Spring Valley Water Company has applied to the commission for authority to issue $300,000 of 6 per cent notes, secured by $400,000 of its 4 per cent bonds, for the purpose of paying off mortgages on watershed lands acquired in Alameda County, and indebtedness incurred in the construction of the Calaveras dam.